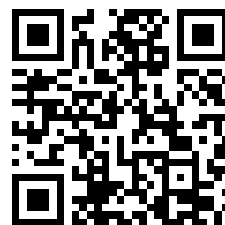

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To all members of the Medical Services of the Army I address this brief note of farewell on the eve of resigning the appointment of Director-General.

Since March, 1938, I have been called on to shoulder many grievous burdens, none of them of our own making. I do not stress their magnitude. That can be appreciated by none save myself. Throughout this term of office I have been sustained by the loyal and devoted service of all who, at home and overseas, have upheld the best traditions of the past, and who in some fields have set up new standards of excellence for the future. None can doubt that fresh trials and vexations lie ahead, but your courage and steadfast fidelity to duty once more will prevail against them, whatever shape they take and wherever they may arise.

I wish you all good fortune, and at the same time I bid farewell to the Medical Services of the Army, whose best interests—as God gave me wit to see them—it has always been my honest endeavour to serve.

W. P. Mac Arthur,

July 31st, 1941.

Director-General, Army Medical Services.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

BURNS IN WARTIME.

BY MAJOR MICHAEL C. OLDFIELD, M.Ch., F.R.C.S.,

Royal Army Medical Corps.

No. 2 Maxillo-Facial Surgical Team.

IN this war there has already been a serious number of burn casualties from incendiary and explosive bombs and it is feared that these casualties will continue for many months.

A high percentage of the wounded soldiers evacuated from Dunkirk and Narvik and civilians from the bombed areas round London have suffered from severe burns. An even higher percentage of sailors wounded in action with enemy aircraft has also been burnt. Many of the fighter pilots escaping from their crippled aircraft have landed safely but have been badly burnt about the face, hands and legs.

There is a general feeling of dissatisfaction with the usual methods of treating severe burn cases and many of the results are most distressing. The pain suffered by these patients is often indescribable. This seems to stamp an impression on the patient's mind and many, even of the most stoical, suffer from tragic psychological collapse. Some remain "nervous wrecks" others become "chronic alcoholics."

Three Degrees of Burn.—It is now generally agreed that there are only three degrees of burn of any practical significance :

1st Degree, scorching of the skin and erythema.

2nd Degree, blistering and partial skin destruction.

3rd Degree, at least full-thickness skin destruction¹ but including those that are deeper.

Dupuytren's six degrees of burn have survived merely for the purpose of catechising the student of medicine. No distinction should be made between burns and scalds; the pathology and treatment are identical. Clinically burn cases are classified as :

(i) Major burns.

(ii) Minor burns.

According to MacCollum [1] (1938) the percentage of total body surface represented by the different parts of the body in adults is :

Head	6 per cent.	
Trunk	40 per cent.	
Both upper extremities ..	16 per cent.	One hand 2 per cent.
Both lower extremities..	38 per cent.	One foot 3 per cent.

MINOR BURN CASES are those in which the burn is mainly of the 1st degree but with small areas of 2nd degree included. They do not involve vital areas, such as limb flexures which might result in crippling deformities, or altogether more than one-tenth of the body surface. They are usually cases which from their local and general condition are deemed suitable for ambulant treatment. A myriad of well-established methods, if intelligently applied, will yield excellent results. The two preparations which are most used to-day, owing to the convenience of their being stored in tubes and simplicity of application, are Amertan and Dettol burn jelly. These are applied after gentle cleansing with a mild, warm antiseptic lotion, such as acriflavine 1 : 1,000, and do not require the use of general anæsthesia. At first-aid stations it is permissible to apply local treatment only to these minor cases.

MAJOR BURN CASES are those which if not most carefully treated may die or suffer from crippling deformities. They include cases with any widespread burns involving more than one-tenth of the body surface especially if considerable areas are 2nd or 3rd degree in type. Most burns of the face, trunk, hands, and limb flexures are to be included in this category.

In order to avoid overburdening many well-worn themes a complete description of the treatment of burns will not be attempted but it is thought interesting to discuss briefly a few of the recent advances and some points of controversy.

FIRST AID.—No major burn case should receive any local treatment at the first-aid station apart from covering the exposed burnt areas with clean cloths or *tulle gras*². Arrangements should be made for these cases

¹ In the classical 3rd degree of burn described by Dupuytren, islets of skin were left intact and were capable of regeneration.

² *Tulle gras* is a useful dressing for burns because it does not adhere to raw surfaces and yet the discharges can escape through its wide mesh. It is made from curtain netting, after the sizing has been boiled out, by impregnating it with sterile vaseline and Balsam of Peru. It is stored in square or rolls with greased paper separating the various layers. *Tulle gras* can be made in any operating theatre or hospital dispensary if the directions given by D. A. Beattie are followed.

to be removed to hospital at once but, while they are waiting to be transferred, shock is treated by warmth, the administration of fluids and morphia. No major burn case should be undressed until the stage of primary shock has passed which is usually some hours after admission to hospital.

IN HOSPITAL.

(a) *General Treatment.*

Burn Centres and Burn Teams.—Special centres provided with carefully-trained “burn teams” should be organized in every district. It is now generally agreed that if efficient treatment is to be provided for cases of severe burns special centres and teams are essential. The occasional treatment given by a junior man who happens to be looking after the patients in a general surgical ward to which the burn case happens to be admitted is inimical to progress. Certain hospitals may be specially equipped for treating cases of burns or a certain number of side-wards set apart for these cases in the general hospital. At the “Burn Centre” treatment is undertaken by a group of specially trained teams who work in close co-operation :

(i) *Plasma infusion teams* for the treatment of shock.

(ii) *Theatre teams* :

(a) For cleaning up and applying local treatment in the early stages ;

(b) For skin-grafting in the later stages.

(iii) *Hæmatologists* who are responsible for taking samples of blood and making such investigations as :

Hæmoglobin concentration.

Cell concentration.

Plasma protein estimations.

(iv) *Bacteriologists* for investigating the type of infecting organisms. Nevertheless it is well to remember that success in the treatment of burns depends more than in any other surgical condition upon the enthusiasm, encouragement and sympathy of the ward sister.

Flies.—In summer and autumn special precautions must be taken to prevent flies infecting the wound and annoying the patient. Cotton-net should be fixed across all open windows. We believe that this method is preferable to the alternative one in which a “mosquito cage,” rather like a shower-bath curtain only made of net, is placed over the patient’s bed. Any streptococcus-disseminating villain who slips in through the door or around the net should receive summary justice by means of a “swotter,” the “flit-gun” or an ethyl chloride spray.

Treatment of Shock.—Plasma or serum infusion has proved to be an extremely valuable addition to the well-established methods of treating shock from burns. No grouping or compatibility tests are necessary. The volume of infusion should vary with the condition of the patient.

It is advisable in severe cases to give a massive infusion of two to four pints of warmed plasma as early as possible after admission to hospital. We

believe it is best to use unconcentrated plasma and infuse it by some gravity method using a cannula. At least 20 to 30 minutes should be spent giving the two to four pints. In severely shocked patients the veins are collapsed and it may be necessary to use extra positive pressure to start the infusion. To continue the injection of large volumes of fluid under pressure with a syringe is dangerous. The patient may die suddenly during, or shortly after an infusion, from dilatation of the right side of the heart.

The actual volume of plasma or serum given during the first forty-eight hours depends upon the concentration of the blood (estimated from the hæmoglobin percentage) and upon the level of the plasma proteins. As soon as the hæmoglobin and plasma protein concentrations have reached the normal level, plasma infusion is stopped.

For example, in a severe burn case in the stage of shock it is common to find the hæmoglobin percentage between 115 and 130 (Haldane normal being about 95 per cent) and the plasma protein about 4 grammes per 100 c.c. (normal being about 5 to 7 grammes per 100 c.c.). This indicates a serious degree of blood concentration caused by loss of plasma by exudation from capillaries into the tissues and also from the surface of the burnt area. With such findings as these on blood examination in the early stages, the indications for plasma infusion are absolute and urgent. Although at first some of the patients may not appear to be desperately ill, owing to the efficiency of temporary compensatory mechanisms, unless large volumes of plasma are infused sudden collapse may occur with little warning. In such cases the usual procedure is to give a massive infusion of two to four pints of plasma as soon as possible after admission. The patient is then taken to the theatre and given a gas and oxygen anæsthetic so that the burnt area can be cleaned up and local treatment, such as tannic acid 20 per cent, applied. A continuous drip infusion of plasma is started in the theatre and continued for about twelve hours; the duration of this infusion depends upon the condition of the patient and the hæmoglobin percentage of the blood. Frequent hæmoglobin estimations are necessary during this time. When the hæmoglobin percentage falls to a normal level (Haldane 95 per cent) the infusion is stopped, because if the blood is diluted with too much plasma, œdema of the lungs and other vital internal organs may occur before superficial œdema calls attention to the condition. It has been shown that plasma infusion is essential in the early stages of shock because the severely burnt patient is unable to mobilize enough plasma protein from his own reserves to tide him over the acute stages. In the later stages, however, a slight reduction in the plasma protein level of the blood *can* be made good by natural processes if the patient is able to take a mixed diet (Witts [2] 1940). A low plasma protein in the later stage therefore does not indicate that plasma infusion is necessary; in fact, if "toxæmia" is established plasma infusion may aggravate the condition. The factors to be considered in deciding whether to use plasma or serum are not yet fully established and on many occasions plasma and serum seem to be equally

efficient. Unconcentrated plasma is easily procured, simple to prepare, and, not being highly viscid, it can be administered by simple gravity methods. On the other hand, plasma is an ideal culture medium and most liable to contamination when stored for any length of time. Serum is more difficult to prepare but more easily stored and it can be supplied in a more concentrated form. It has been found useful in the treatment of œdema when used at three or four times normal strength; being viscid it is more difficult to inject and a syringe is usually required for its infusion; much smaller volumes however are necessary. Serum can be dried and stored for an almost indefinite period under suitable conditions and for this reason dried serum in large quantities is required for treating the burn casualties inflicted upon our expeditionary forces.

Blood transfusion is never advisable in the early stages and is only of value three or four weeks after the burn has occurred if the patient has secondary anæmia associated with severe sepsis. Although the immediate reactions of these cases may be disturbing, the ultimate effect is beneficial. It is wise to aim in these cases to keep the hæmoglobin at about 70 per cent (Haldane) by repeated (weekly or twice weekly) blood drip transfusions of about 1 litre, administered at the rate of 100 c.c. an hour. Fresh blood, taken from donors of the same group as the patient and individually matched with his serum, yields more satisfactory results than stored blood from a universal donor.

Desoxycorticosterone acetate (Ciba) 5 mgm., two hourly, intraveously or intramuscularly, or an adrenal cortical extract, such as *Cortin* or *Eucortine* 10 c.c. has yielded encouraging results in the treatment of secondary shock and toxæmia in the hands of some surgeons. A sufficiently long and adequately controlled series of cases treated by this method has yet to be published to prove the efficiency of the treatment. In theory the premises are sound, but the expense of the treatment makes it difficult to use as a routine at present. The most striking feature of secondary shock and toxæmia is the circulatory failure. The systolic and pulse pressures fall whilst the diastolic rises. The similarity between ordinary surgical shock and adrenal insufficiency has been known for some time. The blood changes after burns have been investigated by Wilson and Stewart [3] (1939). They found that the serum sodium falls while serum potassium, non-protein nitrogen and urea nitrogen rise. There is also increased corpuscular concentration and the serum chlorides fall. They believe that circulatory failure is not due primarily to the low serum sodium level and desoxycorticosterone acetate (D.O.C.A.), although it rapidly restores the normal sodium level, has only occasionally an effect in improving circulatory efficiency in severe toxæmia.

DIET.

Fluids to the limit of the patient's capacity are given by mouth in the early stages. If the patient begins to vomit, a plasma infusion is started at once.

Glucose should be administered freely in the form of sweets or as sweetened drinks of varying flavours such as hot weak tea, orange, lemon, grape-fruit, or lime juice. Liver injury caused by toxæmia is reduced materially if a store of glucose has been accumulated.

Sodium Chloride.—Common salt is given in the form of 15 grain capsules and also mixed with the patient's meals in order to make up for the loss of sodium chloride which has been found to occur in all cases suffering from burn toxæmia. It also serves to increase the patient's desire for fluids.

Vitamins A, B and C are specially prescribed during the stages of established infection.

(b) *Local Treatment.*

Since Davidson [4] of Detroit introduced the method fifteen years ago, the treatment of burns by a process of tanning has been adopted as a routine in most hospitals. The treatment is not ideal by any means; the number of modifications which have been introduced from time to time bear testimony to this but yet they have all failed to solve the problem. The hard unyielding cover tends to obscure collections of pus which may accumulate beneath it and in some parts actual constriction of the tissues may occur. It has recently been proved that tannic acid treatment is absolutely unsuitable for severe burns of the hands and face. In the absence, however, of a better method it is still applicable in burns of the trunk, arms and legs.

(1) *Trunk, Arms and Legs.*

Method of Tanning.

- (i) Tannic acid 20 per cent.
- (ii) Tannic acid 10 per cent and silver nitrate 5 per cent.
- (iii) Triple dye or gentian violet.

Tannic Acid 20 per cent.—Under gas and oxygen anæsthesia careful but gentle cleansing of the burnt area is carried out using swabs soaked in warm acriflavine lotion 1 : 1,000. Only if the affected areas are contaminated with oil or grease is cleansing with ether advisable. Rubbing and scrubbing are most harmful because such trauma causes an increase of exudation and shock. After the dirt and dead skin covering the blisters have been removed, a freshly prepared solution of tannic acid 20 per cent with acriflavine 1 : 1,000 is applied with gauze or a spray to the raw areas. It should be an invariable rule to cover the patient's eyes with pledgets of moist wool before any form of tanning is undertaken because a drop of the tanning solution accidentally splashed into the eye may cause irreparable damage. Between each application the tanned area is dried by an electric hair-drier. When the 20 per cent solution is used a suitable eschar can be produced by three or four applications in the theatre. The original technique in which a 2·5 per cent solution was used has now become obsolete because it took at least twenty-four hours to produce a satisfactory tan.

Tannic acid 10 per cent followed by silver nitrate 5 per cent (or tannic acid 5 per cent and silver nitrate 10 per cent).

The technique and end-results of this method closely resemble those of tannic acid 20 per cent except that after applying and drying the first coat of tannic acid a silver nitrate solution is used to complete the formation of the eschar which is darker than the one produced by tannic acid alone.

Triple Dye (Brilliant green 1 : 1,000—neutral acriflavine 1 : 1,000—gentian violet 1 : 1,000) or *Gentian Violet*.

These solutions are useful when, owing to the condition of the patient (e.g. "Blast lung") it is not advisable to administer a general anaesthetic for thorough toilet. The patients can be treated in their beds in the ward. The dye is applied after the loose skin over the blisters has been removed. The patients often complain of a stinging pain when the dye comes into contact with the raw areas and for this reason some surgeons apply a weak solution of cocaine before applying the dye. The resulting eschar is thin and pliable but it seems doubtful whether the dye, when combined with the tissues, will exert any lethal effect upon bacteria which lurk beneath it.

After-care of the Tanned Area.—A tan, however produced, should be covered by a sterile sheet without any other dressing and should be examined once every twenty-four hours as fresh blisters often appear round the periphery. The loose skin over these should be removed and triple dye applied at once. It is wise also to apply sulphanilamide powder each day to the edges of the tan and to any cracks that may appear near its centre. If the tan has not separated after three or four weeks it is usually advisable to remove it by soaking it in hypertonic saline solution or to cut it away with scissors while the patient is in a bath. Secondary or late tanning of an infected burnt area is extremely dangerous and should never be undertaken in any circumstances.

(2) *Hands and Face.*

(a) *Hands.*—Tannic acid treatment for severe burns of the hands is now whole-heartedly condemned by the majority of surgeons with experience of these cases. Patients with severe burns of the hands, if treated by tannic acid, may develop ischaemic necrosis of the fingers. This is caused by the oedema which develops between the fourth and sixth day beneath the rigid casing. Serious embarrassment of the digital circulation follows, causing contractures and atrophy of the fingers. We have frequently seen patients with hands affected by trophic changes similar to those that appear after section of the lower cord of the brachial plexus (fig. 1 and 2). The fingers are spindle shaped, cold, blue and stiff. The skin is shiny and the nails are curved and brittle. Complete necrosis and loss of the terminal segments of the fingers have been noted on various occasions. For these reasons tannic acid must never be applied in the treatment of severe 2nd and 3rd degree burns of the hands.

Saline baths alternating with frequent saline dressings is the treatment advised. Patients enjoy putting their hands into the bath because pain is relieved and they can start early movements of the fingers. The rim of the bath must be rounded and carefully padded with sorbo or sponge rubber

in order to avoid pressure upon the forearm. The sponge rubber pad is not attached to the rim of the bath so that it can be boiled each day before use.

Patients sometimes, however, complain of slight stinging pain when their hands come out of the bath. This is caused by the drying out of salt



FIG. 1.—Effects of burns of the hands sustained during aerial combat.



FIG. 2.—Trophic changes following tannic acid treatment of severe burns of the left hand.

from solution and can be prevented if the saline is rinsed off in a bowl of sterile water after the bath. Between the baths the dressings are kept moist with saline solution. If it is found that the dressing does not float off easily in the bath, *tulle gras* [5] may be applied to the wound beneath the saline

dressing. This latter dressing can be replaced frequently without disturbing the *tulle gras*. Special jaconet or transparent silk bags (Surgeon Lieutenant Commander J. Bunyan [6]) may be worn over the dressings to keep them moist. These are especially useful when the patient is being transferred by ambulance from one hospital to another.

(b) *Face*.—Tanning is not a satisfactory method of treating burns of the face. Continuous irrigation or frequent saline compresses are preferable.



FIG. 3.—Saline bath treatment used for severe burns of the hand.

Irrigation can be arranged if a thermos reservoir containing warm saline solution is fixed above the patient's head. Fluid is dripped on to the face by means of a rubber tube with a drip feed. The position of the tube is changed frequently by the nurse or the patient himself. A water-tight jaconet collar (Gillies [7] 1940) is attached round the patient's neck. A metal rim raises the periphery of the collar so that the water collects in the intermediate portion and can be drained away by a tube into a bucket at the bedside.

Another trial is being made of the old method of treating extensive burns

of the trunk by continuous or frequent body immersion baths (McIndoe, 1940). A specially heated bath¹ is fixed near the bedside or the bed may be placed in the bathroom. Brown and Blair [8] of St. Louis have been using this method with great success in the treatment of severely burnt children. Ordinary soap and water solution is used in their baths instead of saline. Bacteriologists have shown that soap and water is lethal to most hæmolytic streptococci and so the rationale of the treatment is sound. It may be that in the near future tannic acid treatment of every type of burn case will be abolished ; at present, however, owing to the practical difficulties of treating



FIG. 4.—Gillies collar in use for saline irrigation of the face of a burnt fighter pilot.

large numbers of severely ill patients by the immersion method, its widespread application as a routine measure is not advisable but its value is established in the treatment of severely infected cases which are seen so often in the third or fourth week after a tan has been applied. *The immersion bath is the ideal method for removing an infected tan.*

¹ 110° F. in reservoir, continuous flow at 105° F. keeping the saline solution in the bath at 100° F.

Skin-grafting.—Most extensive 2nd degree burn cases and all 3rd degree cases require some type of skin-grafting procedure to make good the skin loss. Grafting may be advisable during three periods :

- (i) Before the burn has healed to prevent contracture and accelerate healing.
- (ii) When deformities are present after the burnt area has healed but before the contracting phase is over.
- (iii) To cure deformities after the contracting phase is over (six months to a year after the burn).

In the first period it is impossible to render large open granulating wounds aseptic and there must always be an element of doubt about the success of the graft. This risk can be reduced considerably if especial care is taken to prepare the granulations for grafting and to avoid applying a graft until the recipient area is fit to accept it. It is essential to wait until the granulations are flat and a bright red colour. It is useless applying a graft when the granulations are pale and œdematous and if there is an excessive discharge from the wound. Cultures should be taken from the raw area 24 to 48 hours before the graft is applied, because if *Bacillus pyocyaneus* or hæmolytic streptococci are present, it is unwise to apply a graft. Frequent bathing with saline and eusol and a moderate degree of pressure between dressings help to improve the condition of the granulation tissue. Sulphanilamide powder applied locally is useful to remove hæmolytic streptococci or to prevent them infecting the grafted area afterwards. Thin razor grafts with many small holes perforated in them are the most satisfactory in this stage. It is essential to fix them firmly to the raw area and it is advisable to apply moderate pressure. The grafts are fixed most satisfactorily by suturing their peripheral margins to the edges of the defect using *tulle gras* to hold the grafts in position according to the Gillies technique. Frequent saline dressings should be applied over the *tulle gras* after the first forty-eight hours.

In the second period half-thickness as well as Thiersch grafts may be used with success as the danger of infection is much reduced. The immediate "take" is satisfactory in nearly all cases but, as contractures occur in and around the grafts after they have been imbedded, it is quite often necessary to insert more skin at a later date if the deformity tends to recur. The best example of the need for grafting in this stage is when ectropion follows burns of the eyelids. It is essential to repair the deformity as soon as possible to protect the eye but it is often found that, after a month or two, more skin is required and another operation has to be undertaken.

Repair in the third period is the most reliable and precise because an accurate estimate can be made of the tissue-loss and the amount and type of skin required for replacement. All kinds of graft may be used at this time ; Wolfe grafts, if the donor site is carefully chosen, give better cosmetic results than razor grafts and, if the contours have been affected, tubed pedicle grafts containing subcutaneous tissues may be used.

A War Complication of Burns.—"Blast lung" in various degrees of severity is often associated with severe burns when these have been caused by the "flash" from bomb explosions. The complication is latent in many cases and is obscured by the other symptoms. Hæmoptysis is rarely present to call attention to the lung injury. An X-ray examination should be carried out in all doubtful cases. Areas of subpleural thickening or of fine mottling throughout the lung-fields denote subpleural or intra-pulmonary hæmorrhages. If a "blast lung" injury is present the administration of a general anæsthetic for cleansing of the burns is fraught with increased danger.

Bacteriology.—The majority of 2nd and 3rd degree burns become infected by hæmolytic streptococci. In nearly every case these organisms can be cultured from the weeping cracks or edges of the tan or from the uncovered granulations. It is therefore advisable to give full doses (1 grm. four-hourly) of sulphanilamide if there is any rise of temperature, redness near the edge of the tan, or if hæmolytic streptococci are found in the discharges. Cultures from the unhealthy granulations which often result from severe 2nd and 3rd degree burns usually reveal the presence of *Bacillus pyocyaneus* as well as various types of streptococci and staphylococci. The discharge is green and a distinctive sickly odour is perceptible. Sulphanilamide powder applied twice daily and covered by a layer of *tulle gras* and then a saline dressing has been found useful in many of our cases. The powder is applied by means of an insufflator or from an ordinary pepper-pot in much the same way that sulphanilamide powder is applied locally to war wounds to protect them from hæmolytic streptococci.

Conclusions.—The ideal treatment for cases of severe burns has not yet been discovered. Minor cases of burns yield satisfactory results following almost any form of intelligent treatment. Tannic acid treatment for severe burns of the hands is often more dangerous than the burn itself. Oedema occurs beneath the rigid casing and causes constriction, ischæmia and pressure atrophy of the fingers. Sometimes the terminal segments become necrotic and drop off.

Frequently repeated saline baths should be used for 2nd and 3rd degree burns of the hands and face. At present, in the absence of a better method, coagulation by tannic acid or triple dye is still advisable in severe burns of the trunk and limbs. Sulphanilamide in full doses is required at some stage of the treatment in most cases of extensive burns because nearly all become infected with hæmolytic streptococci.

Plasma in large volumes is extremely valuable in the early stages of primary shock. The volume of plasma required depends upon the hæmoglobin percentage of the blood.

I am indebted to Sir Harold Gillies and to Colonel L. Colebrook for their advice and criticism.

REFERENCES.

- [1] MACCOLLUM, D. W. *Amer. Journ. Surg.*, 1938, **39**, 275.
 - [2] WITTS, L. J. Personal Communication, December, 1940.
 - [3] WILSON, W. C., and STEWART, C. P. *Trans. Med. Clin. Soc. Edin.*, 1939, N.S., **50**, 153.
 - [4] DAVIDSON, E. C. *Surg. Gynec. Obst.*, 1925, **41**, 202.
 - [5] BEATTIE, D. A. *Journal of the Royal Army Medical Corps*, 1933, **40**, 352.
 - [6] BUNYAN, J. *Proc. Roy. Soc. Med.*, 1940, **34**, No. 1, 65.
 - [7] GILLIES, H. D., Personal Communication, October, 1940.
 - [8] BROWN, J. B., and BLAIR, V. P. *Southern Med. Journ.*, 1935, **28**, 408,
BROWN, J. B., *Internat. Abstract of Surg.*, 1938, **67**, 105.
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TREATMENT OF BURNS IN WAR-TIME.

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AND

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As there still appears to be considerable controversy regarding the most satisfactory method of treating burns due to enemy action, we propose to describe the method used in a recent series treated in a military hospital.

During the evacuation from Flanders, a military hospital in England was converted into a C.C.S. to deal with the more seriously wounded cases. Twenty extensive second and third degree burns were dealt with. The less extensive burns and scalds are not considered in this communication.

Eight sailors were admitted within three hours of their injury, sustained from an explosion on board a destroyer. The burned areas ranged from 40 to 70 per cent of the body surface and were complicated by gunshot wounds of the limbs, skull and pelvis. Our mortality was 60 per cent—five of the patients dying of severe toxæmia aggravated by their wounds. No first-aid treatment was administered before admission apart from the administration of morphine.

The other twelve cases were British and French soldiers burned by incendiary bombs and shells. Several had been immersed in the sea for several hours, others had rowed small boats, although the epithelium was completely denuded from their palms. Two had been treated with tannic acid and morphine, six with dry dressings and morphine, and the remaining four received morphine only. Twenty-four to ninety-six hours had elapsed since their injury before they were admitted to hospital.

This small series is considered as a whole as these patients were under treatment simultaneously. More recently we have had to deal with R.A.F. casualties severely burned in blazing planes. The methods used were as described below but the first group is taken as a basis for this article as it is unusual for a hospital to have so many cases of this type to deal with at one time.

To reduce the incidence of sepsis and to facilitate nursing, all severe burns were isolated in one ward. Large shock cradles were improvised by the Garrison Engineer within a space of several hours and the ward was kept at a temperature of about 72° F. A special staff of sisters (Q.A.I.M.N.S.) and V.A.D.s were detailed to attend only to the burns.

Fourteen cases were suffering from severe secondary shock or toxæmia and these were treated in the theatre as soon as possible after admission. The others naturally yielded in precedence to the other urgent casualties but all were treated within twelve hours of admission.

Routine Theatre Treatment.—The temperature of the operating theatre was raised to 80° F., and the most severely injured men were anæsthetized with nitrous-oxide and oxygen. A separate paragraph will be devoted to the anæsthetic problem.

The standard technique was as follows :

The injured surface is gently cleansed with swabs wrung out of warm saline and all dirty and blistered epithelium removed. When particularly dirty or oily, ether soap and ether are used for cleansing. A 1 per cent watery solution of gentian violet is then painted over the raw surface by means of gauze. Apart from its antiseptic and coagulating action, this solution clearly demarcates the raw area. The surface is dried by a current of hot air from an electric hair-dryer. Using gauze, a freshly made 10 per cent solution of tannic acid is now applied and, while still moist, the area is painted with a 10 per cent solution of silver nitrate applied in the same manner. Immediate coagulation takes place and the area is again dried by hot air. A further application of gentian violet is made, particular attention being paid to the edges of the damaged area.

On returning to the ward, the patients were nursed under a shock cradle. As a routine, the coagulum was dehydrated four-hourly with methylated ether, and painted with 1 per cent gentian violet in spirit. Areas which appeared moist or thin were treated hourly if necessary. Burned hands and arms were raised on pillows to reduce œdema.

In four very ill patients, this modified Bettmann's technique was replaced by the application of gauze rolls soaked in 20 per cent tannic acid to shorten the time spent in the theatre. The burned areas were rapidly cleansed under gas and oxygen and the gauze quickly applied. This method was not adopted as routine as the coagulum is not open to inspection and moistening can occur unnoticed with an increased risk of toxæmia.

Anæsthesia.—Severe burns were considered sufficiently serious to require the attention of an experienced anæsthetist, taking precedence in this respect over many other injuries.

Gas and oxygen was the anæsthetic of choice on account of the risk of increasing toxæmia by the use of chloroform or ether ; for the same reason evipan and pentothal were considered unsuitable as being liable to increase liver and kidney damage.

In practice no difficulty was found in securing comfortable induction even in the worst cases of facial burns. Several patients were so extensively burnt that there was no part of the body where venipuncture could have been performed for the administration of an intravenous anæsthetic.

The technique of anæsthesia was as follows :

A standard Boyle's apparatus was used. An ordinary face pad with mouth hole was saturated with warm water and was laid gently on the face. This caused no complaint of discomfort and allowed an airtight fit of the face-piece without pressure. Owing to the presence of shock, unconsciousness occurred with five or six breaths of pure nitrous oxide. In about a

third of the cases relaxation was complete enough with gas and oxygen to permit the passage of an intratracheal tube *via* the nose into the trachea. In the remaining cases a few breaths of gas bubbled through the chloroform bottle allowed of the passage of the tube. The pharynx was then packed off with damp gauze to ensure an airtight fit of the tube and gas and oxygen anæsthesia was continued throughout the operation.

In nearly all the patients the whole face and hands were uniformly burnt so that there was no possibility of judging the degree of oxygenation of the blood. The colour of the conjunctivæ was bright pink under all circumstances, leading us to believe that the explosion causing the burns had released considerable quantities of carbon monoxide. Under these conditions to provide a steady quiet anæsthesia with gas and oxygen was difficult even after the insertion of an intratracheal tube. On those occasions when a supplement was needed chloroform was used in preference to ether. This choice was made with the full realization of the theoretical factors involved in regard to the possibility of toxic damage to the liver. In several cases nothing but gas and oxygen was needed. In the others, to facilitate the passage of the intratracheal tube, a deeper level of anæsthesia was needed momentarily. Occasionally too, during an operation lasting perhaps an hour, a dangerously light level of anæsthesia would occur. At such times a few breaths of gas, which had been gently bubbled through chloroform would establish the required level of anæsthesia. Were ether used in such circumstances the result of one or two breaths would be to start the patient coughing or heaving, necessitating full saturation with ether before quiet could be restored. Ether is a poor adjuvant to gas and oxygen since so often its attempted use in small quantities ends in a full ether anæsthetic being administered, the nitrous oxide playing very little part at all, except as a vehicle.

Ward Treatment.—This is best discussed under the headings of Secondary Shock, Toxæmia, Sepsis and Healing. *Primary Shock* was not seen in this series.

Secondary Shock.—Secondary shock was marked in several cases and blood-pressure readings were considered along with the clinical assessment of the patient's condition. If the blood-pressure did not rise after a short period under the shock cradle, combined with the administration of fluids and morphine, early coagulation usually arrested the progress of the shock. Intravenous administration of fluid was rarely necessary as almost all patients consumed and retained enormous quantities of fluids and glucose. When necessary, fluid was administered rectally and intravenously. Desoxycorticosterone acetate was administered in 5 mgm. doses intramuscularly, usually four-hourly. The preparations used were Percorten and D.O.C.A., generous samples of which had recently been supplied to us by the manufacturers (Ciba, Ltd., and Organon Laboratories, respectively). The periodicity was based on the usual signs of shock supplemented where possible by repeated blood-pressure readings. A low diastolic reading was

considered a more pressing indication for the corticosterone than a low systolic reading.

Toxæmia.—We have no certain knowledge of the source or constitution of the toxic substance but we do know that it causes central necrosis of the liver lobules and that it alters the blood chemistry in a way that suggests damage to the suprarenal cortex. Thus coagulation may inhibit the outpouring of toxin from the damaged surface; glucose will help to support the liver and the synthetic corticosterone frequently reverses the changes in blood chemistry.

Toxæmia was present in some cases on admission and these were dealt with by early coagulation. Where toxæmia developed after coagulation, attention was directed to moist or thin areas of the coagulum. Fluids and glucose were forced and fluid intake and output charted. Desoxycorticosterone acetate was administered in 5 mgm. doses intramuscularly and the periodicity here was judged by a careful chart of hourly pulse, temperature and respiration readings. The 5 mgm. were given every two or four hours according to the severity of the toxæmia. The common features of toxæmia which arose were sustained pyrexia, restlessness, rapid pulse and respiration rates (simulating pneumonia), hiccough, vomiting (once blood-stained), delirium and coma. The blood-pressure did not fall until the condition was well established. No blood chemistry investigations could be carried out. Owing to the difficulty of obtaining sufficient synthetic corticosterone, Eucortone (the suprarenal cortical extract made by Allen and Hanbury) was used in some of the cases. Large doses were required and the results were not so dramatic as in the cases in which the synthetic preparation was used.

Unfortunately no necropsies were performed in the five cases that died of severe toxæmia.

Sepsis.—Sepsis was never serious and in no case was the tannic acid regime terminated from this cause. Where necessary, the coagulum was incised, dried and painted with the gentian violet in spirit. In two cases, the coagulum was removed entirely from septic areas and, after cleansing, tannic acid was applied again with a satisfactory coagulum resulting. No sulphonamide was required in this series, although we have proved its value in civil life when severe sepsis ensues.

Healing.—As a rule the coagulum should be left until it strips off readily—usually at the end of the second week. In deep burns the coagulum may take many weeks to separate but unfortunately, in this present series, the cases had passed to another hospital before the coagulum had entirely separated and we have no knowledge of the ultimate result as regards healing of all areas.

It is our practice to treat clean raw surfaces with cod-liver oil or an ointment such as Trinity Ointment (eucalyptus, zinc-oxide, lanoline and soft paraffin). The healing of large raw areas is expedited by the use of Thiersch grafts, and whole-skin grafts may be necessary.

By careful attention to the flexures from the outset and appropriate splintage where necessary the incidence of contractures can be minimized.

It is not unlikely that tannic acid will prove unpopular in many circles in the near future. The efficiency of the tannic acid method depends largely on the time which has elapsed between the actual injury and the treatment and on the thoroughness with which cleansing is carried out before coagulation is attempted. In wartime it is easy to visualize circumstances interfering with both these factors and many imperfect "tans" will occur.

In spite of this, we hope that coagulation will still be adopted as a first-aid method, even in the absence of facilities for thorough cleansing. Even imperfect coagulation will lessen the risk of shock and toxæmia.

The choice of a coagulant is a matter of personal experience and the method described in this article has been used in 300 cases of moderate and severe burns and scalds with gratifying results.

We wish to thank Colonel J. E. M. Boyd, *M.C.*, who was in command of the hospital, for his help and encouragement throughout.

THE ASSESSMENT OF FUNCTIONAL RECOVERY AFTER WAR WOUNDS OF THE LIMBS.

BY LIEUTENANT-COLONEL RALPH BROOKE, *O.B.E.*, M.S., F.R.C.S.,
Royal Army Medical Corps.

THE degree of functional recovery after war injuries is not determined and recorded accurately in many massage clinics.

In wartime, when the number of such injuries is greatly increased both in military and civil practice, some attention to this aspect of after-treatment may be desirable.



FIG. 1.—The instrument for measuring the degree of flexion and extension and inversion and eversion, and the power of flexion and extension and inversion and eversion at the ankle-joint.

In wounds and injuries of the extremities, the disability is broadly speaking due either to pain, loss of movement, or loss of power.

Pain is relative, and in common practice cannot be measured. Its

disappearance is as a rule concurrent with return of power and freedom of movement.

The range of flexion and extension may be measured by means of a measuring calliper before or after each treatment and a record of this in the patient's notes is helpful. There are other movements equally important, which are less easily measured, and for which the measuring calliper cannot be used.



FIG. 2.—Showing the horizontal arm pieces and the graduated disc behind. In this case abduction of the left arm is being measured (power of) and the spring balance is seen below the limb and attached to the lower part of the frame.

Apparatus capable of recording accurately both the range of movement and the power in the various joints may be manufactured at very little cost. It is simple in construction and easy to operate.

In principle it consists of an instrument hinged at the level of the joint with a movable part to which is attached an indicator recording on a scale graduated in degrees. The power in pounds resistance is recorded by a spring balance which is attached by pulleys to the movable part and to the framework (figs. 1, 2 and 3).

This apparatus should form part of the equipment of a wartime Hospital Massage Department and be kept in a small room set aside for that purpose, where the patient goes before or after each treatment and where the functional efficiency of the limb is carefully measured and the figures entered in some form of case sheet (fig. 4).



FIG. 3.—The detachable spring balance may be seen immediately above and behind the ankle. In this case the power of active extension is being measured and the spring balance is connected to the back of the lower part of the frame on which the chair rests.

One that has been found to be efficient consists of a simple folder with four pages. The first is for the history of the case, age, sex, whether right or left handed, etc. The lower half of the page is blank, and here the dates of attendances and the treatment ordered by the surgeon are entered.

The second page contains a column for the date and the treatment given by the masseuse, a second column for the range of movement in degrees, subdivided into columns headed Pronation, Supination, Flexion, Extension, Abduction, Adduction and Rotation. A third column headed Pounds Resistance and similarly subdivided into columns headed Pronation, Supination, Flexion, Extension, Abduction, Adduction and Rotation.

At the bottom of the page is a space headed Normal, in which measurements on the unaffected side are recorded for comparison.

The third page is for a record in graph form (fig. 5), in which the measurements on the affected side are plotted in black ink, and on the sound side in red ink. By this graph the return of function both in range of mobility and power may be seen at a glance.

The fourth page is for special remarks, details of electrical tests, and other special information.

At first sight it might appear that considerable additional labour would be thrown upon the masseuse who is responsible for keeping these records. Actually in practice once the initial difficulties connected with the use of

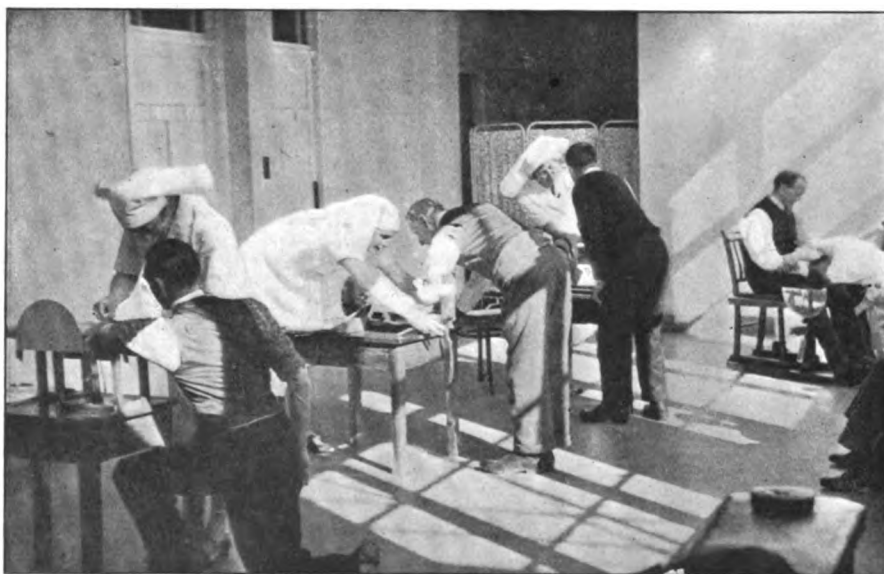


FIG. 4.—The function of the limb is determined and recorded by the Masseuse before or after treatment, and carefully recorded.

strange apparatus is overcome, everything runs quite smoothly and the masseuse ultimately becomes so skilled that the whole thing takes only a few seconds to complete.

At first perhaps a little reluctant to undertake this administrative work, it is interesting to watch the change in attitude as she realizes that the extra labour more than repays her. She is encouraged for she can see at once the progress that the patient is making under her treatment, which may be slow, and unless measured accurately and recorded in this way, may not be obvious to the naked eye.

The patient has no access to his notes, but nevertheless cannot be completely divorced from his surroundings and becomes alive to, and interested

in, his own progress and encouraged by the figures which he cannot help but see. His co-operation, such a valuable factor in treatment, is thus obtained.

If progress lags or is not maintained it becomes at once obvious and the masseuse is then instructed to refer the case to the surgeon, who detecting the need for some more active form of assistance, may save valuable time and spare the patient many unnecessary weeks in the hands of a too persevering or optimistic masseuse.

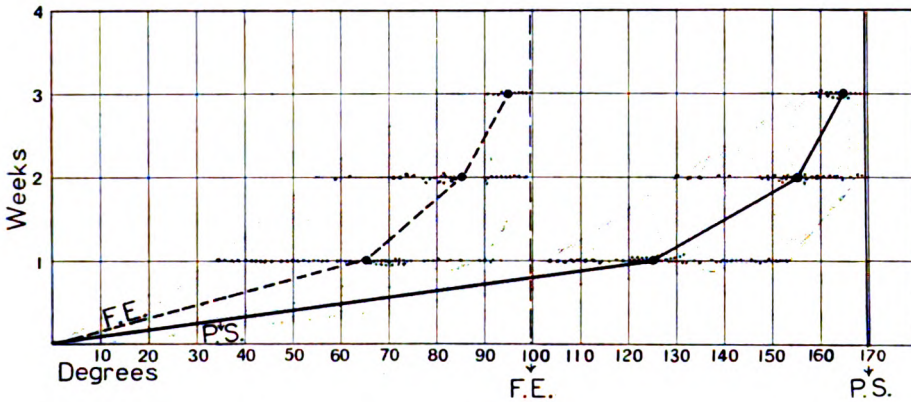


FIG. 5.—The return of function in Graph form. The continuous line represents the range of flexion and extension at the wrist joint, the interrupted line the power in pounds resistance of pronation and supination after a Colles' fracture of the wrist. The shaded areas represent normal variations (56 cases).

As convalescence is reached the date at which the patient is fit to resume duty will depend largely upon the type of work he will be called upon to do. In some doubtful cases the degree of functional return as recorded in his graph may simplify the work of the Surgical Specialist upon whom such a decision devolves. Sometimes the patient may be returned to his unit much sooner than would otherwise have been deemed advisable on a superficial examination performed during the course of an ordinary consultation.

Finally, the degree of permanent disability is indicated as a numeral, and this is invaluable when the question of medical boarding and regrading arises or when the question of pensions has to be considered.

RHEUMATISM IN THE ARMY AND THE RATIONAL CAMPAIGN AGAINST IT.

BY DR. MED. A. J. MESTER,
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THE problem of rheumatism in the Army differs somewhat from that of rheumatism in civilian life. In the Army soldiers do work of practically the same type under the same climatic and environmental conditions. The age groups are balanced to youngsters and adults and there are hardly any old soldiers. On the other hand in civilian life are two main groups, the manual labourer and the office employee, and there is large divergence in ages and conditions of housing and feeding. In the Army the men are usually a good healthy type, they are continually under medical supervision and consequently diseases if any can be diagnosed at an early stage. It should be remembered that there is the possibility of conscious or sub-conscious simulation of diseases. The problem has also to be looked at from a financial standpoint in the event of soldiers being invalided out of the Service with such conditions as rheumatic heart or chronic joint conditions which render the invalid unable to take up civilian work. Acute rheumatic fever does not represent difficulty in diagnosis. The high temperature, periarticular change in the form of swelling and redness of the skin over the affected joints and the general condition of the patient, complete the picture and are sure indications that the patient should be in hospital. More difficulty may be met with in cases of subacute rheumatic fever, in which the rise of temperature may be small and not continual, so that, at the moment of examination, there may be a normal temperature. The articular changes are not very marked, there may be no periarticular swelling and no redness of the skin over the affected joints. The diagnosis in fact is based entirely on subjective symptoms such as history of joint pains. Such cases are often not diagnosed correctly. A mistaken diagnosis in such cases may be of great import and even lead to serious consequences. The intensity of the rheumatic infection cannot be judged from the intensity of the objective or general signs. Rheumatic fever is not a joint disease but a general disease which attacks more often the central circulatory system, i.e. the heart, in the form of endo-myocarditis and sometimes even a pancarditis; mostly endo- and myocarditis together. Not infrequently the conducting system of the heart is involved. Quite frequently we find rheumatism as exclusively a heart condition without the involvement of the joints. This occurs mostly in young individuals, rarely over 25 years of age. In these cases the early diagnosis of rheumatic heart disease is of primary importance, especially from the point of view of prognosis. In these instances very often the signs and symptoms, especially at an early stage of

the disease, are not very marked. They may simply be fatigue, slight weakness and tachycardia. Such signs and symptoms may easily be attributed by an inexperienced medical officer to the new conditions of service to which a recruit has not been accustomed before. In such cases, if we have the slightest suspicion, we may make a correct diagnosis after a few days' observation in a detained ward. If possible a sedimentation rate test should be made, also a total white and differential blood-count. In every case an accelerated sedimentation rate (S.R.) is sufficient indication for further observation. Where an acceleration of the S.R. is found and rheumatism suspected, further investigations are indicated such as X-ray electrocardiography.

More rarely we meet cases of chronic joint inflammation, rheumatoid arthritis. This disease presents some difficulty in early diagnosis because the early symptoms may not be very marked, they may present themselves in the form of vague pains in the small joints of fingers, toes, wrists, elbows, knees, etc. Sometimes there are small periarticular swellings of joints without redness of the skin and without any rise of temperature. There are no heart symptoms beyond some tachycardia. The liability to miss the diagnosis with consequent serious results for prognosis and treatment is very evident.

Osteoarthritis, usually called in this country osteoarthritis, nearly always affects the big joints, the hips, knees and shoulders, and is mostly unilateral. This disease is hardly ever met with during the normal age of the soldier and, if found, the arthrotic changes are so small that they do not interfere with normal duties. When osteoarthritis is suspected and bone changes discovered after physical examination, and possibly confirmed by X-rays, the question arises whether such changes are likely to interfere with the soldier's future efficiency. We meet sometimes cases in which there is great disproportion between the subjective and the objective symptoms. While some patients complain of much pain and discomfort they present on examination very little arthrotic change and limitation of joint movements while others do not suffer any pain and very little discomfort but are found on physical examination to have a certain degree of limitation of movement with considerable arthrotic change on X-ray examination. Osteoarthritis is a local disease and the condition of the affected joint is the only deciding factor as to efficiency for military service.

Another disease which may be met with is spondylitis ankylopoietica (spondylitis adolescens). This is a very chronic disease of the rheumatic type which affects the joints of the vertebral column and is fortunately comparatively rare. The early symptoms are rather vague and polymorphic. They may present themselves as insidious intercostal neuralgia or sciatica or intermittent myalgia, which on careful examination is found to be secondary to a primary spondylitis ankylopoietica. If this disease is diagnosed, the individual should be rejected as unfit for military service, as spondylitis ankylopoietica is a progressive disease affecting the intervertebral

and the costo-vertebral joints with subsequent interference with thoracic movements. Not infrequently they are in the form Pierre-Marie-Strümpell (spondylose rhizomélisque) the large joints such as the hips or shoulders, being involved.

The remarks made above in respect of osteoarthrosis regarding liability for military service apply also to spondyloarthrosis deformans in a greater degree, because here we find marked and widespread hypertrophic changes which are not limited to one vertebra alone. The subjective symptoms may be nil. The X-ray picture may present considerable lipping of the vertebral bodies which will not be considered of great pathological importance unless an inflammatory process is also present. The differential diagnosis can be arrived at by careful observation, white blood-count, differential count, and especially S.R. An accelerated S.R. is always indicative of an inflammatory process in such cases.

Acute muscular rheumatism may be generalized or localized. Most often it is found in the neck-muscles (torticollis rheumatica) and the lumbar region (lumbago) but also in the muscles of the thorax (pleurodynia). Chronic muscular rheumatism is doubted by many authors and the large number of terms used to describe it, fibrositis, panniculitis, cellulitis, cellulalgia adiposalgia, etc., go to show that not even the locality of the pathological process is agreed upon. Chronic muscular rheumatism *per se* is of small import as regards military service except that it must be borne in mind that this condition may be a secondary symptom to a primary organic cause, such as new growths of bones, inflammatory conditions of bones, arthritic changes in the intervertebral joints or even ureteric calculi.

Of great importance on account of frequency are the rheumatic conditions of nerves, especially the sciatic nerve. Sciatica may be acute or chronic and may be neuralgia or neuritis of the sciatic nerve. In neuritis we find, beside the pains, trophic changes, disturbances of sensibility and abolition of tendon jerks. Sciatica may be radicular, funicular or peripheral and according to the locality of the morbid process the symptoms may be different. In acute sciatica marked by severe neuralgic pains, sometimes with inability to walk, the patient should immediately be admitted to hospital. In chronic sciatica symptoms are very polymorphic, varying from slight temporary pains to permanent disability. In severe cases patients should be admitted to hospital so that accurate diagnosis may be made as to whether the condition is an essential sciatica or a symptomatic condition (ischialgia) secondary to malignant disease, hypertrophy of prostate, spondylitis adolescens, etc. For a long time sciatica has been known as one of the diseases that a malingerer is likely to copy. The knowledge of objective symptoms, such as the symptom of Laségue, coupled with a history of pain, by a would-be patient is very likely to deceive the examining medical officer in view of the fact that, in sciatica, blood changes are not marked, the S.R. is usually normal, the X-ray rather indefinite and it is difficult to discover a simulator. A very careful examination of all the movements of the affected side compared

to the healthy will usually enable the physician to distinguish the true disease and a faked one. The non-rheumatic joint affections, chronic and acute, of the infectious diseases, such as measles, influenza, undulant fever as well as gonorrhœa, syphilis and tuberculosis, do not represent special problems of diagnosis and treatment.

The problem of simulation and aggravation of disease is a very serious one. The largest number of malingerers complain of rheumatism (pains) especially of muscles and nerves. The knowledge of this fact may sometimes lead us to suspect simulation where true disease exists. Such a mistake is very grave from the patient's point of view as, in such cases, the disease remains untreated, and takes on a chronic character making the individual a permanent cripple.

Rheumatism as a social problem was first recognized after the Ministry of Health Report, published by H.M. Stationery Office in 1924, "The Incidence of Rheumatic Diseases." Other countries in Europe and North and South Americas also recognized these diseases as a social problem. The large increase of rheumatic cases cannot be explained entirely by the fact that they are better diagnosed but may, perhaps, be attributed to conditions of warfare during the world war of 1914-18. Damp trenches, bad housing in barracks, bad clothing and food, all of these are predisposing factors to rheumatic diseases. Keeping in mind the crippling effect of these diseases, especially acute rheumatic fever with subsequent cardiac involvement, and chronic articular rheumatism with its lasting joint conditions, it will be realized how important it is that this problem should be recognized. Such recognition may save large sums of money which would otherwise have to be paid in disability pensions. In the present state of our knowledge of rheumatic diseases we are not in a position to take very effective prophylactic measures, such as might reduce to a minimum the incidence of these diseases. Our hope lies therefore in combating the condition in its early stages. I suggest firstly that rheumatic cases should be centralized under the care of specialists (rheumatologists). Medical officers in charge of units should send rheumatic cases to these special hospitals at once. At these hospitals careful examination should be made and a correct diagnosis arrived at. In cases of acute rheumatic fever the condition and function of the heart should be carefully noted.

The patients should not be discharged from hospital too early. The complete disappearance of such general symptoms as pain and joint swellings should not be regarded as a complete cure of the patient because frequently the morbid process goes on without any signs or symptoms. The deciding factor should be the sedimentation rate. The patient should not be discharged as cured until the S.R. comes down to normal, 5 to 7 mm. Westergren. When the S.R. has been normal at least twice in a week the patient may be sent to a convalescent home for three to four weeks and treated adequately. During this time of convalescence S.R. should be estimated once a week and, if it remains normal, the soldier may then be returned

to his unit. In cases in which the heart is involved in the course of acute rheumatic fever special attention should be given to the condition. Such a state, myo- or endocardial, should be regarded as a chronic and not an acute one. In the case of endocardial involvement the subject is no longer fit for military service. On the other hand, with myocardial involvements, the patient should be kept in bed for at least six to eight weeks. The leading factors in our treatment will be the patient's condition on physical examination and also blood examination, white cell count, differential count, S.R., the electrocardiogram and X-rays. When the patient is finally allowed to get up and to walk for a few minutes daily the heart condition should be checked by the Ekg. and the S.R. done. Return to normal life should be very slow and gradual, the patient being sent to a convalescent home after a normal S.R. and Ekg. He should stay there at least three months and his condition be controlled by physical examination, S.R. and the Ekg. In this way we may be able to cure a number of cases who will eventually be returned to their units as fit for military service. The rheumatoid arthritic cases depending on the intensity of their conditions may be sometimes able to return to duty. Cases of essential muscular rheumatism and some cases of acute sciatica are, after appropriate treatment, generally fit for military service, but cases of chronic sciatica may only be able to do light military duty.

All rheumatic patients must be kept for a considerable time on salicylates which have not only a curative but also a prophylactic action. The question of doses of sodium salicylate and other salicylic acid compounds and pyrazolon derivatives, the duration of treatment, the methods of giving the salicylates— orally, intramuscularly or intravenously—together with the question of surgical intervention for the removal of “infectious foci,” as well as other forms of treatment, such as gold therapy, protein shock therapy of rheumatoid-arthritis, etc., constitute a chapter of medical study which requires a number of years to acquire.

Conclusions.—Having regard to the above, the problem of rheumatism as it affects the Armed Forces can be dealt with by accurate diagnosis and adequate treatment, preferably in a rheumatic hospital and at the hands of expert rheumatologists. From the results obtained in anti-rheumatic centres in peacetime I am confident that similar good results could be obtained amongst a military personnel during the present war.

Since writing this article the *British Medical Journal* for February 1, 1941, has published a report on the recommendations of the British Empire Rheumatism Council which are almost the same as my recommendations above.

THE PROPHYLACTIC TREATMENT OF VENEREAL DISEASE.

BY MAJOR J. M. OFFICER,
Royal Army Medical Corps.

VARIOUS methods of prophylactic treatment of venereal disease have been tried in the Army, but no comparative figures of results appear to have been published, so that the following account of the three methods used in China may be of interest.

In Hong Kong there are seven Preventive Ablution Centres and, until April, 1939, the treatment consisted of irrigations with potassium permanganate and the application of calomel ointment.

Soldiers were instructed to report to the nearest P.A. Centre as soon as possible after exposure to infection.

A regimental orderly was on duty at each centre and, when a soldier reported for treatment, he was instructed to cleanse the glans penis and adjacent genital area with antiseptic lotion, irrigate the anterior urethra with 1 : 10,000 solution of potassium permanganate, dry the parts and finally apply 33 per cent calomel ointment. On completion of these procedures he was given a ticket to prove that he had used the centre.

In April, 1939, protargol instillations were instituted in one of the centres in place of potassium permanganate irrigations, and this modified technique gave such encouraging results that by September its use had been extended to all except two centres.

The striking advantage of protargol instillations over potassium permanganate irrigations is summarized in the following table :

	Number using	Number who later developed V.D.
Potassium Permanganate Irrigations ..	1,288	160 (12·42%)
Protargol Instillations	1,918	20 (1·04%)

The newly adopted method of preventive treatment differed from that previously used in that 2½ per cent solution of protargol was substituted for potassium permanganate irrigations, 5 c.c. of 2½ per cent solution of protargol being instilled into the urethra and held for 15—20 minutes. In two of the centres the regimental orderlies were replaced by trained R.A.M.C. orderlies.

In the meantime, there were complaints from the troops that the protargol instillations were painful, and in consequence there was a decrease in the number using the centres and a corresponding increase in the number of cases of venereal disease.

In 1938, before the introduction of protargol, 15,430 used the centres, whereas in 1939 only 9,767 used them.

On March 1, 1940, the treatment in the centres was simplified. Irrigations and instillations were no longer used, as it was considered that any

antiseptic sufficiently strong to destroy the gonococcus was likely to damage or devitalize the delicate urethral mucosa.

The treatment adopted therefore consisted in thorough cleansing of the penis and parts around with soap and water, followed by swabbing with 1 : 10,000 solution of hydrarg. perchloride; micturition in gushes and the application of calomel ointment. No lotions or ointment were introduced into the urethra.

Although the percentage of cases developing gonorrhœa after this treatment proved to be the same as amongst those who had used protargol, there were two favourable indications in the results, viz. there was a distinct reduction in the total number of venereal infections and fewer cases were admitted suffering from venereal disease after failing to carry out prophylactic treatment. The results of the introduction of the simplified method of prophylactic treatment may therefore be regarded as encouraging in these respects. The following table illustrates these points :

Period	Total number using centres	No. who later developed V.D.	No. who failed to take precautions	Total V.D.
1st six months. (Protargol instillations or Pot. Permang. irriga- tions)	5,274	202	118	320
2nd six months. (Simple Method) ..	5,447	183	102	285

During the first six months, a few centres were still using potassium permanganate, but the total who used protargol was 4,622. Of these 114 (2·4 per cent) later developed gonorrhœa, whereas during the second six months 5,447 carried out the simplified treatment and of these 133 (2·4 per cent) afterwards developed gonorrhœa.

The number who failed to take precautions was 118, whilst protargol instillations and potassium permanganate irrigations were in use, as against 102 when the simplified method was employed.

The total number of cases of venereal disease for the period September 1, 1939, to February 29, 1940, during which the protargol instillations or irrigations with potassium permanganate were in use, was 320, as against 285 during the period March 1, 1940, to August 31, 1940, and 305 during the corresponding period in 1939. This is summarized in the following table :

Period	Type of Centre	Number using Centres	Those who later developed		Those who failed to take precautions	Total V.D.
			1, Gonorrhœa	2, Other V.D.		
1/9/39 to	Protargol	4,622	114 (2·4%)	64	—	—
29/2/40	Pot. permang.	652	13	11	—	—
	Total for six months ..	5,274	127	75	118	320
1/3/40 to	Simple method	5,447	133 (2·4%)	50	102	285
31/8/40						

SUMMARY.

The results of these three methods of prophylaxis are compared in the following table :

Type of Centre		Number using Centres	Number who later developed V.D.	Percentage failures
Pot. Permang. .. ..	..	1,288	160	12.42%
Protargol .. ..	..	4,622	178	3.85%
Simple Method .. ..	..	5,447	183	3.35%

CONCLUSIONS.

(1) As a result of simplifying the treatment in P.A. Centres there has been an increase in the number attending for prophylactic treatment.

(2) The omission of protargol instillations and of potassium permanganate irrigations from the preventive treatment has not resulted in any increase in the number of cases of gonorrhœa, thus suggesting that the introduction of antiseptics into the urethra has little or no effect on the prevention of gonorrhœa.

(3) There were thirty-five fewer cases of venereal disease during the six months in which the simplified method has been in force than occurred during the previous six months, and there were twenty fewer cases than in the corresponding period in 1939.

(4) The treatment is simple and painless, requiring no special apparatus or specially trained attendant.

In conclusion the writer would like to thank Colonel J. T. Simson, A.D.M.S., China Command and Lieutenant-Colonel C. Armstrong, *M.B.E.*, R.A.M.C., for their helpful criticism and permission to forward these notes for publication.

APPENDIX.

INSTRUCTIONS FOR P.A.C. ORDERLIES.

(1) Examine the soldier to make sure that he is not already suffering from venereal disease. If he is suffering from venereal disease, give no treatment and see that he reports sick.

(2) See that the soldier washes his penis and parts around with soap and water, paying particular attention to the knob, ring, bridle string and scrotum.

(3) The orderly should then soak three pieces of wool in the lotion (1 : 10,000 solution of hydrarg. perchloride).

With one piece, thoroughly swab the penis and parts around, including the scrotum and penis, with the second piece, the knob and bridle string and with the third piece, the mouth of the pipe.

(4) GET THE SOLDIER TO URINATE IN GUSHES.

(5) Repeat No. 3 above.

(6) Rub the ointment well in, especially the knob, around the ring and bridle string. Rub well in for five minutes.

(7) The hands of both the soldier and the orderly should then be thoroughly washed.

(8) Issue the chit.

PERSONAL EXPERIENCES IN FRANCE.

BY LIEUTENANT D. I. MCCALLUM.

Royal Army Medical Corps.

ON May 20, 1940, the 13th Casualty Clearing Station, then near Domart, about 15 miles northwest of Amiens, was evacuated, making towards St. Pol. About forty of our number, who could not be accommodated in motor transport, went on foot, and by the time we reached Doullens we found ourselves cut off by German motorized units. Colonel Morris decided that our only chance of escape was to divide up into three parties, each commanded by one of the three officers. I, being the junior officer, was sent off first with two Serjeants, two Corporals and eight men. My instructions were to contact Allied Forces if possible.

As our road to St. Pol had been cut off by the German motorized units, our one chance of escape seemed to be westwards. We made across country for some two miles and then came on the Doullens-Auxi le Château road. There we stopped a French civilian who was doing his best to cycle past without recognizing us. He was very agitated and attempted to make off hurriedly when we inquired whether there were any Germans in the vicinity. When pressed further, he merely indicated with his thumb that he had seen them along the road. There was evidently no time to lose so we made a dash across the main road, to be greeted with a hail of machine-gun bullets all of which fortunately passed over our heads. (At this time we were wearing our Red Cross brassards.) The tank which had spotted us was only about 200 yards away and covered the bridge over the River Authie, so we had no alternative but to swim.

Of our thirteen, six were non-swimmers, so we contrived to make a hand bridge with straps from our equipment. Serjeant Wilson, being the strongest swimmer, went first and was followed quickly by four non-swimmers. While the fifth was crossing, one of the buckles became undone, and the soldier found himself in difficulties. He was, however, taken to safety by the timely action of Sapper White. The rest crossed without much trouble and, in our wet clothes, we proceeded to a nearby farm where we had a meagre meal consisting of raw eggs.

It was decided to travel by night and sleep by day. At ten-thirty that night we started off on the first stretch, knowing we were surrounded by enemy motorized units whose engines we could hear throbbing in the darkness. By way of completion to this day's adventures, we were chased by quite the most vicious bull I had seen for many a long day.

At about two o'clock on the following morning, two of the men had to fall out through sheer fatigue. We took them to an evacuated farm where we made them as comfortable as possible and left them with food enough for some days.

The rest of us pushed on and during the next four or five nights made our way through woods and the Forest of Crecy, sleeping by day and never daring to talk above a whisper. It was here we came very near to being found by a German patrol which passed about twenty yards from our hiding place.

On our sixth night out we had the unpleasant experience of running into marshland which had not been shown on the one map we boasted between us. After wading in mud up to our thighs for two and a half hours we hit on a pathway which led to a railway. There we put up for the night in a small hut.

The next day we were given shelter—and incidentally a compass—by a kindly French official who assured us that Mussolini had been killed, that the Turks and Russians had entered the war and that the British were going to force their way across the Somme and would soon be in that area. For a week we lived cooped up in a hut with plenty to eat but surrounded by the Germans.

At midnight on June 3 word was brought to us by another friend that the Germans would be occupying our billet within half an hour. We set off at once and found large concentrations of German troops on all sides. Indeed, we almost ran into German guards at le Crottoy.

The following day we got in touch with a Belgian family who proved most helpful. They pointed out to us that our plan for rowing across the mouth of the Somme was quite impracticable owing to the rapid change of the tides, and that our safest way was to swim. In preparation for the crossing we equipped ourselves with the inner tubes of several motor tyres to support the non-swimmers. We also made a rope to be carried by the swimmers and held by the non-swimmers. Two things were essential for the crossing. The tide had to be as far out as possible and, in view of the fact that the Germans had machine-gun posts on both sides, it had to be a dark night as there was a mile and a half of sand all within range of the machine guns. It was decided that, rather than wait for another week when conditions might have been better, the crossing should be attempted at once, although it meant facing an incoming tide.

There were now five swimmers and six non-swimmers. Late at night we raced across the sands, carrying our equipment in sacks and bending low. There was no moon, and no one spotted us. We were almost within sight of the other bank when, with the sound of the in-rushing tide in our ears, we came on the Somme River. The tide was certainly coming in very quickly. Our first misfortune was to discover that the soldier who had been entrusted with the rope had dropped it in the rush across the sands. Then two of the men, thinking they could make the crossing more easily at a different spot from the main party, went off by themselves. What happened to our two comrades we do not yet know. The main party—nine all told—got across, the Serjeant and the Sapper doing magnificent work in helping the non-swimmers. By the time we reached the other bank we had had to discard

all our clothes but our shirts and the current had carried us 200 yards upstream in a 300 yard crossing. For half an hour we waited on the other side for our lost comrades but they did not rejoin us.

For five or six hours we walked barefooted and almost naked. During that time we had to dive into the roadside on two occasions when our own bombers dropped flares and proceeded to bomb the bridge at St. Valery a mile or two distant. Then we came upon a hut that must have been occupied very recently by a Highland Regiment. We rigged ourselves out with jackets and great coats. Later that night, at a deserted farm, we found sufficient French civilian clothing for all nine, two of us setting rather a new fashion for hikers by resorting to "dancing pumps."

The Germans were in occupation here and the next night we had a very uncomfortable journey passing Cayeux. The clatter made by nine pairs of feet on this pebbly shore can well be imagined. To avoid detection we walked in shallow water where a new difficulty awaited us, for it seemed to us that the phosphorescent glow from our feet must have been seen for miles around.

The next few nights passed without any particular incident and by Wednesday, June 12, we had reached Mers adjoining le Treport. Serjeant Wilson and I, being the two who could speak some French, went out, as we had done on several occasions, to get provisions, leaving our comrades to enjoy a well-earned rest in an evacuated house. On returning, we were shocked to see a German sentry on guard at the door. One of our lads managed to signal from a window, waving to us to get back down the road. All seven had been captured. For seven to eight hours we two fodder hunters hid in a hen house and, at 10.30 at night, set out towards Eu, passed it about midnight and proceeded westwards. We were now making for the Seine. The Germans were to be seen everywhere but, as most of the houses here had been deserted, we had no difficulty in finding provisions on the farms.

About four o'clock on the morning of June 19, a week after losing our comrades, we reached the Seine where we lay on the bank within earshot of German sentries for eighteen hours. During that time Serjeant Wilson managed to blow up the inner tube of a motor tyre with a bicycle pump. The tube was fitted into a sack and an interlacing network of twigs worked into the sacking so that we had a fairly firm raft for carrying our clothes and what little food we had with us. We crept away from the sentry post for about half a mile and entered the water at 11.30 at night. It was almost a full moon and we were seen and fired at but not hit. The water was covered with a thick scum of crude oil from the refineries which had been fired by the Allies as the Germans were advancing. On emerging at the other side we hardly recognized each other. We were both like negroes.

That night we spent in a nearby barn. In the morning we learned from the farm people that the Germans were here also. Our plan now was to make for Jersey, for, having been house-doctor there some time before, I

knew something about the island. All this time we made our way by night, covering between twelve and fifteen miles at a stretch, entering a barn in the early hours of the morning, sleeping there till early afternoon, having a snack from the food that we carried and then about 7.30 in the evening making our way to the nearest farm and asking for some food. The kindness of these peasant folks is beyond description. During the ten weeks we spent in the Occupied Zone we were refused food on one occasion only.

Four nights after swimming the Seine we were making our way westwards near the town of Caen when at 2 a.m. a voice ahead of us snapped "Halt!" Immediately afterwards a figure staggered out of the ditch by the side of the road. I thought it was a drunk Frenchman at first but was soon disillusioned when I found myself, a minute later, facing a German corporal sentry complete with fixed bayonet. He ordered us to advance ten paces. To our right, at the side of the road, were drawn up half a dozen German lorries and several staff cars. From one of these emerged an Officer who talked for a short time to the Corporal, the only word I recognized being "Englische." He then turned his attention to us and, in French even worse than my own, very deliberately asked "Qui êtes-vous?" I explained that we were refugees returning to Caen. (At this time we were in civilian clothes and were complete with berets.) The officer then asked for our papers. I replied "Pas de papiers." "Pourquoi?" I elaborated that we had had to leave home so quickly that all our papers were left behind. It was difficult for him to understand why we should be travelling by night and all my arguments did not save us from being searched. Fortunately, all he found in our baskets was eatables from the last farm and a spare pair of shoes. Obviously puzzled, he shrugged his shoulders and barked "Allez." To my horror Serjeant Wilson, who had been silent up till now, politely asked in a pronounced English accent: "Voulez-vous un fromage?" to which the officer replied in no uncertain fashion.

On June 26 we made for the River Orne. All bridges across the river were closely guarded as was the Paris-Caen railway which runs parallel to the river at this part. At about 10.30 at night we cut our way through the thickets by the side of the railway, crawled over the rails on our stomachs, and so reached the river's edge. We were prepared to swim across but found it was possible to wade as the water came not higher than the level of our necks. From that point we continued to go cautiously by night having our shoes muffled with pieces of sacking. At last we reached the coast opposite Jersey and I was very glad that the end was in sight as I was suffering from acute muscular strain. Imagine our dismay when we heard that the island had been occupied three days earlier! To cap our misfortunes, the people in this particular district were under penalty of death if they should help the British. After a much-needed two days' rest we proceeded southwards, now making for the Pyrenees as our only method of escape from France.

The terms of the 'Armistice had not yet reached this part. Ten days later we were able to thank a Belgian refugee for the comforting news that part of France was still unoccupied. We now directed our steps towards Tours. On several occasions we narrowly escaped Nazi sentries and, as there was a curfew on all German-occupied territory, we could not bluff our way if challenged.

By Thursday, July 25, we were within twenty miles of Tours. There a kindly French artisan invited us to his house for a meal and, hearing that we intended to swim the Loire and the Cher in our bid for freedom, suggested a much better and safer way. This good friend not only offered to lend us each a bicycle but to conduct us personally through Tours, where the streets were full of German troops, and to deposit us and the machines at a farm twenty miles on the other side of the town. His plan worked perfectly. Not once in our journey were we questioned by German sentries. Incidentally the countryside here was the most beautiful that we had yet passed through. Touraine has well been described as the "Garden of France."

After taking our leave of our generous host we proceeded on foot in an easterly direction towards the zone "non-occupé," and by 4 o'clock next morning we were within ten miles of Free France. Here we slept in a deserted farm and about midday we set off again. Part of the time we played the role of peasants working in the fields, carrying forks to make our play-acting complete. Having ascertained from the peasants where exactly the frontier lay and where sentries were posted, we crossed to Free France near Loches about 5 o'clock on the evening of Saturday, July 27. At Chateauroux an official explained to us that we would be interned "somewhere in France" and, as he himself was not interested in interning us, he advised us to make for Montpellier, 300 miles away. We had very little money left but by hitch-hiking we arrived there on July 30. Inquiries here led us to believe that our greatest chance of escape lay in Marseilles where the Americans were in charge of British interests. We arrived in Marseilles within twenty-four hours, with about twenty francs between us, and were told that we would receive money only if we gave ourselves up to the French authorities and were interned. Consequently we found ourselves in Fort St. Jean the next day.

After one month, during which time I made three attempts to escape, I managed to get clear of French Authorities and so back to Britain and freedom.

Editorial.

U.S.A. ARMY MEDICAL REPORT (1940).

THE Report of the Surgeon-General of the United States Army for 1940 has recently come to hand and provides a good subject for an article as it deals with many augmentations and changes in the United States Army Medical Service resulting from the European War. Though produced in June, 1940, the Report publishes vital statistics for 1939 only, and so we shall have to wait until next year to take account of the interesting increases in strength which are certain to be brought into prominence in statistical tables and figures. There are, however, certain increases in 1939, and this year is notable for the first stationing of American continental troops in Puerto Rico and a consequent increase in the local diseases well known to attack the native troops there in previous years.

“The admission rate, all causes, for 1939 was 529 per 1,000 strength, and is the lowest on record for the Army.” The numbers for a thousand of strength for the different countries in which significant numbers of troops were stationed, are as follows : Panama, 693 ; Philippines, 668 ; United States, 544 ; Total Army, 539 ; and Hawaii, 389. The climate of Panama and of the Philippines accounts for the high rates there recorded while the very low figure for Hawaii reflects the almost ideal conditions prevailing in that island. The deaths, set out in the same form, from all causes, were : Philippine Islands, 4·04 ; United States, 3·06 ; Total Army, 2·79 ; Panama, 2·47 ; and Hawaii, 1·33. To show the marked effects of enlisting the services of many different races the tuberculosis admission rates may be taken as typical. They were, for the peoples specified, as follows :

Filipino Enlisted, Philippine Islands, 6·37 ; Puerto Rican Enlisted, 4·62 ; Coloured Enlisted, U.S., 3·46 ; White Enlisted, 2·38 ; Total Army, 1·80 ; White Enlisted, U.S., 1·80 ; White Enlisted, Panama, 1·55 ; All Officers, 1·00 ; White Enlisted, Hawaii, 0·64. It is interesting to find that the Filipinos get such a high incidence of the disease. Coloured troops, though still high, are tending to become relatively immune and to show a lower rate, while the White Enlisted of the United States and Panama show a considerable resistance to the infection and the Hawaiians are characterized by a remarkable freedom from tuberculous manifestations. It is satisfactory to find that there were no cases of paratyphoid fever and that only seven cases of typhoid were recorded, of whom two were still doubtful at the time of submitting the report. Gastric and abdominal illnesses seem to be much as with us if we may take rates for the professional army as a comparison. “Gastritis and acute enteritis” together accounted for 18·5 per mille, appendicitis for 11·0, colitis and other enteritis for 4·5 and

ulcer of duodenum for 1·6. It is possible that, with the calling to the colours of numerous persons from strictly civilian occupations, as at present in our Army, a good many may be found to be unable to tackle the Army ration owing to digestive troubles kept in check by the serving of special dishes in the home, but the relative freedom of the Standing Army from gastric trouble is worthy of note. The portion of the Report dealing with the early part of 1940 is of great interest though not yet indicating the increases now in progress. Under "Enlisted Personnel Subdivision," it is recorded that the authorized strength of the Medical Corps was increased from 8,643 on June 30, 1939, to 13,628 on June 30, 1940. "This increase was utilized in two ways: (1) To increase the number of enlisted men assigned to station and general hospitals to take care of the increased hospital patient load incident to an expanding Regular Army; and (2) to organize the Medical Department units and detachments for field service."

"Since December, 1939, the following Medical Department tactical units and detachments have been reorganized or newly organized:

"Medical regiments 2; 1 new. Medical battalions 6; all new. Provisional medical battalion 1; new. Medical squadron 1, reorganized and augmented; Medical troop 1; ditto. Ambulance company 1; reorganized. Veterinary company (Separate). Attached Medical, for the Infantry, Field Artillery and Engineer units in 6 Infantry Divisions."

Medical regiments, battalions, squadrons and troops! These seem to be new developments but, in reality, are not very different from the Field Ambulances and Casualty Clearing Stations familiar to us. They may prove to give that degree of elasticity which we are conscious of having lacked when our medical units were put to the severe test of a new kind of war; or they may, on the other hand, prove to be too fluid and require to be thought out in terms of Field Ambulance and C.C.S. equipment; nothing but a real test, including a retreat, can decide! But it is very encouraging to find the American Army Medical Service trying these new methods. We wish them every success.

Hospital Trains are evidently the subject of extensive plans and a unit has been designed in conjunction with the Pullman Co. for 500 patients. "Such hospital trains will be used . . . in the theatre of operations if suitable railway equipment is available." The size of this train is, of course, very convenient if it can be used, but we fear that there may be difficulties in finding sidings available when there is great congestion, as in active operations. There is much to be said for smaller trains and more of them.

Of the types of medical activity suitable to an Army in peacetime, the Army Medical Museum and the Library are outstanding features. The Museum is administered under the supervision of the Professional Service Division and is under the immediate direction of a Medical Officer who is the Curator. The Library is in a big building which, when we visited it in 1926, was adequate to its functions but has now reached saturation so that a new Library is about to be provided. The personnel consists of an officer,

the only commissioned officer on duty there, and 31 civilian employees, five of whom have the title of principal librarian, senior librarian, etc. There is an appropriation of \$25,000 a year for the purchase of medical books, periodicals, old, rare volumes and other accessories. It is doubtful if this sum will suffice for the future as it is strained to the utmost at present. The Surgeon-General appears to control the medical organization of the Flying Corps, the Veterinary Service and, like our Director-General, the Army Dental Service and the Nursing Service. On all these subjects it would be possible to write also but we confine ourselves to the strictly medical portion.

We offer our best congratulations to the Surgeon-General on a most interesting Report.



Clinical and other Notes.

MILD SEQUELÆ FOLLOWING ANTI-RABIC VACCINE ADMINISTRATION.

BY MAJOR P. F. PALMER,
Royal Army Medical Corps.

A LADY who had been given the mildest course of anti-rabic vaccine, consisting of a daily injection of 2 c.c. for seven days, soon after completion of the treatment complained of pains over the hips, constipation and an inability to feel the act of defæcation when it occurred. Later she complained that even gently rubbing herself with a towel over her hips caused tingling pains.

That this was due to the injections was corroborated by a Warrant Officer who was undergoing a daily injection of 5 c.c. for fourteen days. He stated that he suffered from a somewhat similar condition. His bowels had always been extremely regular and he visited the bathroom on getting up each morning. On two or three occasions he visited the bathroom as usual, sat on the commode, and after a while gave it up as a bad job, thinking that he would try again later. To his surprise, on replacing the lid, he noticed that he had passed a stool. This occurred shortly after the beginning of treatment and before the course was completed. These mild effects correspond closely with the major sequelæ which always occur within thirty days, 88 per cent beginning within twenty days. The earliest symptoms noted have been within seven days of the commencement of treatment and the latter case began about the same time.

IMPROVEMENT IN THE STRUCTURE OF THE BUCKET LATRINE.

BY O.C. A FIELD HYGIENE SECTION.

THE bucket latrine, which has been chosen in many Divisions as the most effective method of disposal of fæces, has been found to suffer from a few defects which are easily and cheaply remedied with the use of tools and material readily to hand under active service conditions.

The prime defect noted in many inspections of billets and camps was the lack of a self-closing lid. In the regulation superstructure of the latrine a wooden bar is fitted to prevent the lid opening beyond a right angle. This device causes the lid to fall under the influence of the force of gravity when the user vacates the seat. Unfortunately it also causes discomfort by

pressure upon the back during the act of defæcation and hence is often broken or removed by the soldier in an excess of unease.

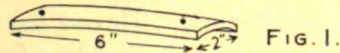


FIG. 1.

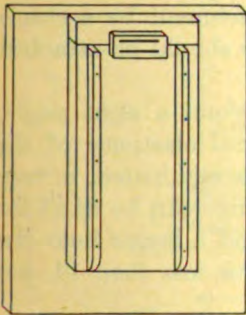


FIG. 2.

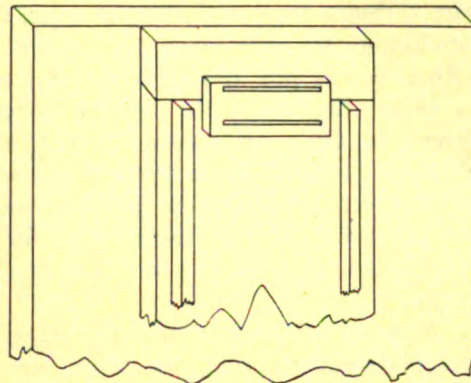


FIG. 3.

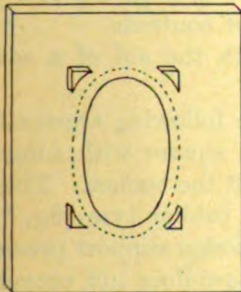


FIG. 5.

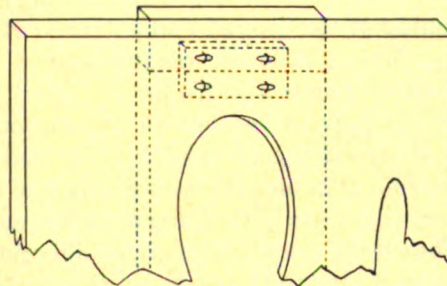


FIG. 4.

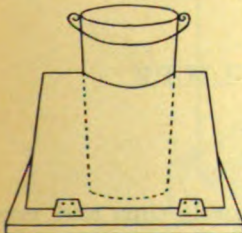


FIG. 6.

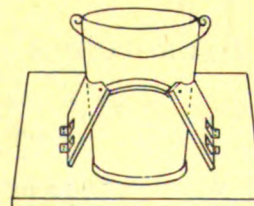


FIG. 7.

To overcome this difficulty the hinge described and shown diagrammatically (figs. 1, 2, 3 and 4) is installed by my Section. It is indestructible, permanent and comfortable in use.

The materials needed are: 2 pieces of thick wire 10 inches long

4 staples ; 1 used outer motor tyre (sufficient for 36 hinges). The tools required : 1 hammer ; 1 nail ; 1 penknife.

To make the hinge, cut out a strip from the rubber tyre 6×2 inches and cut a hole in each corner (fig. 1). Thread the wire through the holes in the strip and draw it tight, squaring it off with a few blows of the hammer. Bore corresponding holes in the latrine cover and seat (fig. 4), thread the wire through these and bend it over, finishing the attachment by a staple straddling each wire below (figs. 2 and 3). The rubber should be attached with the outer side upward to give full effect.

With this device the lid can be easily opened beyond a right angle, indeed to 180° , yet closes automatically by the natural elasticity of the hinges. The need for a wooden bar and its supports is eliminated, a very much lighter lid of three-ply wood can be used, the hinge can be fixed far back allowing a longer resting area for the buttocks, and a larger hole can be constructed. Finally the cost of the improvement is less than 1d. per hinge.

A second difficulty encountered is in deficiency of the bucket guides and platform. The guides below the seats have here been shaped to fit closely to the rim of the bucket (fig. 5). This prevents the seat sliding and the holes moving from the opening of the bucket thus giving rise to soiling of the ground and entrance of flies to the bucket contents.

These guides are readily shaped and attached with the aid of a saw, penknife, nails and hammer.

To prevent the bucket rocking on its platform the following apparatus is designed (figs. 6 and 7). It consists in a wooden square with hinged wooden attachments the free edges of which are cut to fit the bucket. These free edges are joined together by means of pieces of rubber tyre (fig. 7). Thus if the bucket tilts in one direction the opposite wooden support presses upon it and restores it to the vertical. This structure does not prevent the easy removal of the bucket for cleansing.

The material needed is wood, a used tyre, staples, and wire, and the tools, a spokeshave, nail and hammer.

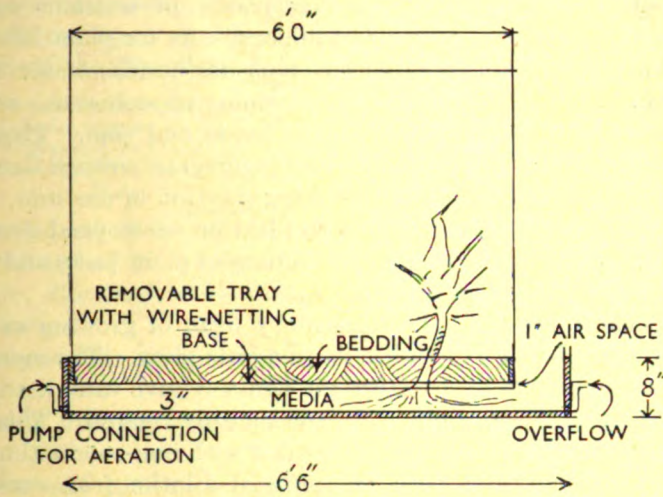
HYDROPONICS AND AGGREGATE CULTURE.

BY MAJOR R. S. DE C. BENNETT,

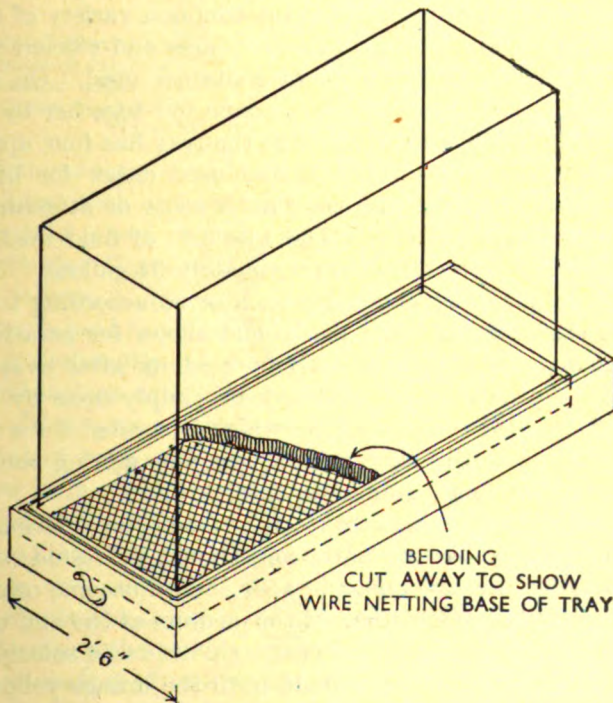
Royal Army Medical Corps.

THE above subject has interested me for a considerable time and now that the war is turning towards the East, I feel that if hydroponics and aggregate culture were scientifically developed it would have a very definite bearing on the general health of troops.

Hydroponics is a type of culture that has been done by natives in a crude way for centuries and has only recently been placed on a scientific basis by Professor Gerichi.



1" scale section.



Isometric sketch.

Hydroponics consists of cultivating plants in nutrient solutions or, put more simply, water plus essential mineral salts for plant life.

The mineral elements essential to plant life besides water and carbon are nitrogen, calcium, magnesium, potassium, phosphorous, sulphur plus trace elements such as manganese, iron, boron and zinc. These minerals are normally in soil; in hydroponics and aggregate culture these minerals are added to the water to make a growing solution or medium. The ideal regions for outdoor hydroponics are tropical or subtropical desert regions where there is bright light, heat, the minimum of plant pests and an average nutrient temperature of 70° to 75°.

Most people know the very elementary form of growing mustard and cress on wet flannel or a hyacinth bulb in a bulb glass. The more elaborate form of culture consists of a watertight non-corrosive tank made of glazed earthenware, wood, steel, iron, or cement suitably treated. This is encased in outer walls, the space between being filled with non-conducting material; the tank is then half-filled with the mineral solution; an outlet drain is provided at the bottom of each tank and used as an overflow or aerating pipe as necessary; a wire mesh tray is fitted on the top of the tank containing the bedding material, excelsior or wood wool with a surface covering of peat moss. This supports the plant and excludes light from the nutrient solution, eliminating the growth of algæ.

This is only a rough description of the common variety of tank and one of the most suitable on account of its cheapness and efficiency, so that an idea may be gained as to the type of container used. On a large scale commercial installation these tanks are connected together by pipes, etc.

In the diagram it will be noticed that the tray has four uprights (which may vary in length) joined together and used either for lifting out the tray and if necessary examining the plant's roots or attaching cross wire supports for tall growing plants. The amount of fluid medium required for a depth of 4 inches would be approximately 34 gallons. The air space under the tray is generally about one inch or so according to the type of plant root growth; the air space at the end allows for aeration and gives room for checking the depth of nutrient medium after evaporation, etc. Aeration is of vital importance and may be simply done by an air pump or cycle pump attached to the air pipe which is aerated for a minute or so once or twice a day, at the same time thoroughly mixing the medium the salts of which tend to sink to different levels.

Another point of great importance is to keep the solution mildly acid and the pH (hydrogen-ion-concentration) should be tested weekly. This should be 4.5 to 6.0, i.e. the alkacid paper should become orange yellow in colour when dipped in the medium. If the medium at the end of a fortnight or so shows an alkaline reaction, sufficient sulphuric acid solution, one ounce to the gallon of water should be added until the orange yellow reaction is obtained.

There are about thirty nutrient formulas in use, according to climatic

conditions ; commercial grade salts may be obtained from any good local artificial fertilizer agent. One of the favourite formulas is that of Shive and Robbins of the New Jersey Agricultural Experimental Station :

Monopotassium phosphate	gr. 109
Calcium nitrate	gr. 370
Magnesium sulphate.. .. .	gr. 200
Ammonium sulphate.. .. .	gr. 32
Water to	gallons 5

To this is added as mentioned before two stock solutions, A and B.

A is composed of 49 grams each of boric acid, manganese sulphate and zinc sulphate, dissolved in 64 ounces of water to which is added gr. 10 of copper sulphate.

Two teaspoonfuls of this solution are used to 5 gallons of nutrient medium.

B is simply iron ammonium citrate 12 grams dissolved in 16 ounces of water.

Four teaspoonfuls to each gallon of nutrient medium are used.

It is necessary that all stock solutions should be kept in the dark and must be prepared and added to the water in the tank separately in order to prevent precipitation of sulphates and calcium salts.

The following formula would probably be more useful in Egypt or Aden owing to the amount of nitrogen used by plants in relation to the brighter sunlight :

Double superphosphates	gr. 43
Magnesium sulphate.. .. .	gr. 44
Potassium nitrate	gr. 296
Ammonium sulphate	gr. 192
Water to	gallons 5

To this of course trace element solutions A and B, as mentioned before, must be added but with an increase to 14 grams of iron ammonium citrate. The above formula is one of many recommended by Messrs. Withrow and Biebel of the Perdue University Experimental Station, Indiana.

Aggregate culture is perhaps simpler as mineral aggregate, viz. sand, gravel or cinder, is used in place of soil and the principle more easily grasped. The process is constantly to flush the mineral aggregate with nutrient solution in combination with seepage, etc.

It is difficult to give an unbiased opinion on the merits of the two systems but one or both could be tried.

There have been some remarkable crops grown under soilless culture up to twenty times the normal. Of course these are exceptional and under ideal conditions in California. There is no doubt that this new method is going to play a very important part in the future in arid zones. As an example it is at present being made use of in Wake Island, a Trans-Pacific air-liner station where there is not a vestige of vegetation. An experimental plant of 120 square feet of tank was at first used giving a weekly production of 33 pounds of tomatoes, 20 pounds of string beans, 15 pounds of vegetable marrow, 20 head of lettuce and 44 pounds of sweet corn. The plant has

now been increased tenfold and the air-liners are delivering vegetables to other rocky islands on their route.

The chief points in favour of developing this culture are its cheapness, rapidity of crop growth, greater yield (about eightfold), choice of location, small area of ground used and all the year round supply of vegetables which, from a medical point, cannot be stressed too much on health grounds.

I do not in any way wish to give the impression that hydroponics and aggregate culture is the panacea of agriculture but there is no doubt in my own mind that it is going to play a very important part in the future development of arid zones all over the world.

Experimental work is being carried out at Imperial Chemical Industries Research Station, Zealotts Hill, Bracknell, Herts, and also by Messrs. Suttons, and Reading University.

Literature on this subject: "Soiless Growth of Plants," by Messrs. Ellis and Swaney. This authoritative work is obtainable at any bookseller or Messrs. Chapman and Hall. "Plant Chemiculture," by Messrs. Dawson & Doran, 4615 W. Washington B.Vd. Los Angeles, Cal., U.S.A. "Hydroponics as viewed by California," by Hutchinson, C.B. (1938). "Market Growers Journal," Vol. lxii. "Hydroponics," a magazine devoted to soiless culture, published by The Hydroponic Publishing Company, 2211 Woodward Avenue, Detroit, Michigan, U.S.A.

My whole point in drawing attention to this little known type of agriculture is that a start should be made in the Near East. I would suggest a trial at hospitals in Aden and Egypt, by professional nurserymen, of whom there must be many in the Corps who could adapt themselves to this new science.

NOCTURNAL ENURESIS.

By MAJOR R. J. ROSIE,

Royal Army Medical Corps.

ONE of the most annoying of therapeutic problems with which the medical officer has to deal is that of nocturnal enuresis. This is not uncommon among young soldiers and it is thought that a short account of the disorder and its treatment by suggestion may be of some interest. Enuresis is very common in childhood. Addis (1936) reported that one out of almost every five children brought to the Child Guidance Clinics in London for whatever reason suffered from enuresis. Most of these cases cease about puberty but a few continue into adult life.

In the Army the unfortunate sufferer is too often regarded with suspicion by his unit officers and by the hospital staff. It is occasionally thought that he is himself in some way responsible for his plight and that what he really requires is a good scolding and proper training. Punishment for an act which he cannot resist and of which he is not even aware leads to a

sense of injustice. Soldier sufferers contain a high proportion of those who have enlisted in haste and repented at leisure and there are a few only too willing to use this disability as a means to obtaining their discharge from the Service. The majority, however, are anxious to accept treatment and in some cases parents have encouraged enlistment in the hope that Army life and discipline would remove the distressing symptom. When, as often happens, it fails to do so the unfortunate victim must bear the jeers of his comrades. His life becomes miserable and he is anxious to seek escape from the Army to the security of his own home.

Ancient home remedies still survive. There exists in some quarters a strange belief that the eating of the body of a cooked mouse will cure the condition. A common remedy is a bobbin fixed to the middle of the patient's back at night.

It is usually considered that a great variety of causes can produce enuresis i.e. phimosis, adenoids, hyperacidity of the urine, polyuria, unduly sensitive bladder, poor parental training, etc. The varieties of treatment in use are therefore also numerous and, if these fail, the disappointment aroused makes subsequent attempts at treatment more difficult. Disseminated sclerosis, spina bifida, locomotor ataxia, general paralysis of the insane and other organic diseases of the nervous system can cause involuntary dribbling of urine. Epilepsy is also responsible for a certain number of cases and bed wetting may be an early symptom of schizophrenia. These should, however, be regarded as cases of incontinence and not of nocturnal enuresis. This term should be limited to those cases which are of psychological origin. There is no doubt that emotional disturbances can affect bladder control. In situations of stress and strain such as occur in the case of a student awaiting an oral examination voluntary control over the sphincter may be diminished or lost. In most cases of nocturnal enuresis there is no loss of sphincter control and no frequency of micturition during the daytime. As suggestion in the hypnotic state can, in many cases, remove the symptom a purely organic basis for the disorder can in these cases be excluded. Although suggestion is most effective upon the mind in the hypnotic state it is also inherent in every variety of treatment and the masked suggestion behind the belladonna mixture or operation of circumcision may explain the favourable results that may follow such lines of treatment.

Enuresis occurs in mental deficiency although not as frequently as might be expected. Soldier sufferers are often of at least average intelligence and are made miserable and unhappy by their symptom. It occurs among all classes and after every variety of training.

It has been suggested that nocturnal enuresis is an outlet for sex tension and a substitute for masturbation and that the tension relief of micturition is an attempt to enjoy the pleasures of masturbation without the guilt attached thereto. In most soldier sufferers, however, masturbation and incontinence co-exist in the same case.

Certain cases may be caused by an unconscious desire to escape from the difficulties of life and return to the sheltered existence of the baby. One wets the bed like a baby because one wishes to have the privilege of being a baby again.

During infancy the passage of the warm stream produces pleasurable sensations in the urethral mucosa. The infant obtains pleasure from the act and urinates when and where it wishes. The act is a creative activity, in that the child is producing something from its own body without outside assistance and the ability to forcibly expel the substance gives it a sense of power. These pleasurable activities are soon subject to adult regulation and control. Rewards are given for good urethral behaviour, and the child has to submit to adult regulations by day. During sleep inhibitions are relaxed and the child can continue to indulge these earlier pleasurable activities and at the same time can give expression to its unconscious feelings of hostility for and revenge on the parent who withheld the form of erotic gratification desired by the child.

One or other of these faulty emotional attitudes may be associated with the development of the symptom in children but its persistence in adult life may be caused by associations which produce a conditioned reflex.

During the past year six adult cases of nocturnal enuresis have been treated. Four were of a highly strung nervous type and the remainder phlegmatic and non-emotional. All showed other signs of psychological disturbance. One case suffered from occasional hysterical fits. Long standing enuresis is, however, likely to be complicated with symptoms of an anxiety state which may be induced by the unskilful and unsympathetic handling of the patient who is rendered miserable and hopeless by a succession of failures of treatment. Two of the six cases treated were severe. The frequent recurrence of the symptom since childhood, both in civil and in military life, had made their lives one of misery. One unfortunate, without parents or home, had in civil life been turned away from many lodgings owing to his failing. The feeling of hopelessness present in this case was tragic. The remaining four cases suffered from occasional incontinence but in no case was the free interval longer than three months.

Five cases were treated by suggestion while in the hypnotic state and the sixth case by suggestion in the waking state. All responded to treatment. At least six months without a wet bed was taken as the criterion for a cure of the symptom but no attempt was made to discover the shortest time in which it was possible to obtain a cure by this means. The patient must first be encouraged to tell his story in his own way and will benefit from this opportunity to relieve his mind to a sympathetic listener. Some may appear to be callous about their symptom but this aloofness is only assumed. When the patient realizes that his complaint is understood and confidence in the ability of the physician to help him out of his misery is aroused, much has been attained.

Light hypnosis only is required and the mere induction of this may by

itself do good and be followed by an increased feeling of confidence. The hypnotic state is induced because, owing to the peculiar attitude of the subject to the physician, ideas which in the waking state would pass unheeded are now received and acted on without criticism. Suggestions made in hypnosis can influence bodily processes which normally are controlled by the involuntary nervous system and can increase or delay their activity. Suggestions can increase or decrease salivary and gastric secretions, bowel peristalsis, flow of bile, etc. The suggestions must be made confidently and the whole atmosphere must be one of cure.

In the treatment of psychoneurotic disorder as in that of other branches of medicine one should consider the condition as a whole and not in terms of the symptom alone. The analytic approach or treatment of choice may for various reasons not be practicable, and the use of simpler methods which can remove the symptom may be justified. Although this treatment is mainly symptomatic and the basal causes of the condition may not have been attacked the symptom is removed and the patient's life is rendered more bearable. The subsequent and continued gratitude of the patient is some measure of the success of this treatment in nocturnal enuresis. The adult sufferer from nocturnal enuresis is a most unhappy person and this treatment is recorded to draw attention to a simple and effective remedy which seems to be little practised at the present time.

REFERENCE.

ADDIS, R. S. (1936). *Proc. Roy. Soc. Med.*, **29**, 1515.

Current Literature.

BARLING, S. Amputation of the Extremities in Cases of War Wounds.
Post-Graduate Med. J. 1940, May, v. 16, 162-7.

The author refers to the considerable modification that has taken place in the attitude of surgeons towards the problems of amputation stumps and the fitting of artificial limbs as the result of experience gained in the treatment of large numbers of cases after the last war. These results of research and investigation carried out under the Ministry of Pensions at Roehampton and other limb-fitting centres are now available for the guidance of surgeons.

The improvement and standardization in design of light metal limbs has to some extent tended to standardize the type of operation which precedes the fitting of the limb, and a very much more successful final result is probable if the surgeon knows something of the limb-fitters' problems and plans his operation so as to produce a stump which is in every way suitable for what is, after all, the only matter of real importance, the subsequent fitting of the prosthesis.

Though artificial limbs have to some extent become standardized, it must be clearly understood that each patient to whom one is to be fitted presents an individual problem.

The psychology of the patient, his capacity for adaptation, his occupation, no less than the length of the stump, its shape and variation in the site of scars and its capacity to stand up to daily wear and tear, are all individual problems.

The Stump : The primary function of the stump is to act as a lever, and the question of length is therefore all-important. If it is too short the area of contact with the limb socket is insufficient for the leverage required to make the proximal joint effective. If it is too long the blood supply of the distal portion is imperilled, and the stump will not stand up to the wear and tear of daily use without development of pain and ulceration, especially in the lower limb where the movements of flexion and extension during walking cause a piston-like action of thrust and withdrawal of the stump in the limb socket.

For the same reason scars are a source of weakness, and the amputation scar should be planned so that it cannot adhere to bone or be subject to direct pressure. A sufficient margin of healthy tissue should be allowed at the site of injury or disease, or the lowered resistance of damaged tissues may lead to pain and ulceration after some years of use.

During the period of healing, and for the first month, the stump should be left as much as possible at rest, but care should be taken that it does not become flexed and that joints do not become stiff. These complications can be prevented by attention to posture and by occasional active movements of the joints. After the first month regular exercises should be carried out to improve the condition of muscles and joints. Shrinkage of the parts sets in and should be assisted by firm bandaging of the stump from the tip upwards with a flannel bandage, as until this process is stabilized the stump is not fit for its final fitting with a limb.

Sometime before this, however—in two or three months in favourable cases—a temporary limb of simple pylon type with plaster socket should be fitted to accustom the patient to some of the problems arising from the new position, and to assist in hardening and shrinking the stump. [The practice of fitting a temporary limb for its effect on the stump, which is often the reverse of what is desired, is condemned in a Ministry of Health Circular, E.M.S./Gen./296, especially in regard to its adoption by unskilled persons. If a pylon must be used it should be made and fitted only by the limb-maker who is subsequently to make the permanent artificial limb.]

The ideal stump should taper somewhat towards its distal end, should be well covered but without bulky masses of tissue, and should have a normal range of movement at its proximal joint. It should not be unduly sensitive to pressure.

Indications for Amputation : These may be conveniently considered under the following headings :—

- (A) Primary amputation.
- (B) Amputation during the stage of progressive sepsis.
- (C) Secondary amputation.

(A) *Primary Amputation*.—In some cases the indications for immediate amputation are clear ; in others the decision will be taken as the result of findings when the wound is explored under an anæsthetic. Great comminution of bones and damage to joints, failure of circulation in the distal parts of the limb and evidence of serious nerve injury may indicate the necessity of primary amputation, and to these may be added the presence of serious major injuries elsewhere, the age of the patient and the absence of satisfactory conditions for immediate after-treatment of the wounded limb.

It must be borne in mind by surgeons accustomed to dealing with civilian injuries caused by industrial accidents and motor smashes that high velocity projectiles cause wide-spread damage in the depths of the wound, often at a considerable distance from the apparent track of the projectile, and that vessels and nerves may be torn, and extensive hæmorrhage may take place along intermuscular planes, thus opening up channels for the spread of sepsis. The surgeon may safely be more conservative in wounds of the upper extremity since the risk to life from sepsis is smaller and the capacity of the limb to survive severe vascular injury greater than in the case of the lower limb. Any portion of a finger or thumb should be preserved if possible, as a hand with these stumps is generally more useful than any artificial appliance.

Two points in the anatomy of the lower limb are worth considering in deciding for or against conservative treatment. The big muscle masses in the thigh, when injured, form a favourable nidus for growth of organisms, especially anærobæ, possibly from the favourable growth pabulum afforded by the released muscle sugars ; and the vascular supply of these long muscle bellies is easily damaged, predisposing them to the transmission of sepsis. The second point is the danger to the vascular supply of the leg and foot resulting from wounds in the popliteal region.

(B) *Amputation During the Early Period of Sepsis*.—These are cases seen first a few days after wounding, with already established sepsis, and cases in which conservative treatment has failed. The patients are sick men and the decision to amputate may have to be taken promptly in order to save life. They include (1) cases with rapidly spreading sepsis often with gas-forming anærobæ ; (2) cases which have never recovered from the initial shock but remain lethargic with low blood pressure and slowly ingravescent sepsis in the wound ; (3) cases in which circulation in the distal part of the limb fails, either frank gangrene appears or low vitality opposes no barrier to infection.

(C) *Secondary Amputation*.—Some of the indications in this group are the occurrence of acute arthritis in a large joint, the presence of widespread osteomyelitis and pyæmia, and the gradual failure of the patient with widespread sepsis. The recognition that the limb in such cases will ultimately

have less functional value than an artificial limb, and that ablation will save many months of possibly vain suffering, may turn the scale in favour of amputation, and long standing cases of limb injury should be reviewed from time to time with this in mind.

The Operation.—Primary amputation often has to be carried out in the shocked patient and two or three hours spent in resuscitation, which should include blood transfusion in the exsanguinated patient, are desirable. The presence of the damaged limb, however, is itself a cause of shock, and if the systolic blood-pressure is 100 mm. Hg or over, amputation should be carried out with little delay.

A tourniquet should be used for the peripheral amputations. In amputations at or near the hip joint the femoral vessels should be ligated through a vertical incision afterwards prolonged into that of the amputation. Flaps should be of approximately equal length, as this ensures a better blood supply to each; they should be situated so that the scar will be free from pressure or adhesion to bone.

In the presence of sepsis it is often wise to sacrifice an inch or two of length to get healthier tissue for the flaps. Guillotine amputations are apt to be unsatisfactory and cause prolonged and painful convalescence. If sepsis is unavoidable the flaps should be lightly sutured over paraffin gauze, and in any case drainage for forty-eight hours is advisable. The main nerve trunks should be drawn down slightly and divided with the knife without crushing or ligature, except in the case of a large trunk like the sciatic which contains a definite artery and may be lightly ligatured.

If long standing sepsis has preceded amputation, a longer period of post-operative rest of the stump should be enforced.

Amputations Above the Knee: The ideal stump should have a length of 10 inches from the top of the great trochanter, or of 12 inches in a tall patient. The total length of the flaps should be one and a half times the diameter of the limb at the point of section; they should be of anterior and posterior type, and of approximately equal length. A circular amputation is satisfactory if preferred, the scar being transverse when sutured, and retracting slightly posteriorly. Such a stump is fitted to a socket with an ischial bearing and permits the fitting of a most efficient prosthesis.

If the stump has perforce to be shorter than 10 inches every inch of bone that can be conserved is of value, as even a length of 6 inches only will at times permit of a stump controlled limb. If the stump is shorter than 6 inches, a heavier and less efficient limb is necessary and the stump no longer acts as an efficient lever. After amputations through the hip joint the fitting of a limb is difficult, as the bucket cannot be efficiently fitted close to the side of the pelvis, owing to the concavity left by removal of the femoral head. If possible, therefore, the head and as much as possible of the neck and trochanters should be left when amputating through the hip. If it is impossible to leave as much as 6 inches of shaft, the bone section is best made at the level of the lesser trochanter.

Below Knee Amputation: Six inches of tibia are desirable, and amputation at this level constitutes the modern site of election. A 4-inch stump is still useful, and even one of 2 inches or less may at times be utilized by the limb-maker as an efficient lever. Antero-posterior flaps, or a circular amputation cut so as to allow a slightly longer anterior than posterior flap, are best. The fibula should be divided 1 inch above the level of the tibial section. If the tibial tuberosities are free of scars, the limb bearing is taken here. Failing this, the bearing must be ischial, but this gives less efficient control. If the knee is ankylosed, in whatever position, it is probably best not to give a stump longer than 4 inches.

Syme's Amputation : The Syme stump has the disadvantage, inherent in all long stumps, of poor peripheral circulation, and in most pensioners after the last war reamputation was necessary, as these stumps did not stand up to wear and tear. In many civilian cases however, especially in children, Syme stumps have given long years of service, and the lessened mutilation of the longer stump undoubtedly makes an appeal.

Max Page [*Brit. Med. J.*, 1939, ii, 77] has suggested a modification of the classical operation in which the bones are divided 1 inch above the ankle-joint, and the heel flap fitted snugly over the bone ends, giving a stump which wears better and is easier to fit with an artificial limb.

Amputations of the Upper Limb: The relative inefficiency of prostheses for the upper limb warrants a strong bias in favour of preservation of any portion of fingers or thumb which can possibly function. When the hand has gone, however, the most suitable stump from the limb-fitter's point of view should be provided. As in the lower limb, amputations through joints should be avoided. The scar should be sited to lie transversely across the bone ends where, if primary union occurs, it may move freely over the adjacent bone. The early fitting of a limb gives the patient a more hopeful attitude and encourages the nutrition and general function of the stump.

Amputation Below the Elbow : Amputation $2\frac{1}{2}$ inches above the ulnar styloid process gives the most useful stump, and any length of bone up to within 4 or even 3 inches below the internal humeral condyle is useful. If the length of bone would be shorter than this the amputation had better be above the elbow joint.

Amputation Above the Elbow : The ideal level is 3 inches above the elbow joint, but any bone that can be left up to 6 or even 5 inches, measured from the tip of the acromion process, is useful. Above this the stump is fitted as for a shoulder amputation and loses its value as a lever.

Amputation At or About the Shoulder: In these amputations it is useful to preserve a portion of the upper end of the humerus since, though useless as a lever, it preserves the contour of the shoulder and forms an anchorage for the fitting of the shoulder cap of the artificial limb. The scar should lie vertically below the acromion, out of the way of pressure. W. B. FOLEY.

Reprinted from " Bulletin of War Medicine," November, 1940.

Competence of Venous Valves. Annotation, *Lancet*, September 21, 1940.

The tests for competence of the valves of the great saphenous vein have been simplified by McCallig and Hyerdale. They point out that all the surgeon wants to know is whether the valves in the three systems of veins—superficial, deep, and intercommunicating—are competent or not. To demonstrate incompetence in the great saphenous vein they examine the patient standing. The fingers of one hand are placed over the saphenous opening, the fingers of the other hand percuss a dilated segment of the vein below. If an impulse can be detected by the upper fingers, incompetent valves and a dilated saphenous vein are strongly suspected. Proof is provided by reversing the procedure; a wave passing down the vein can only mean incompetent valves. With competent valves local injection of the varices stands a good chance of success. Tying the main vein is needed as a preliminary to injection where the valves are incompetent.

In order to test for the competence of the inter-communicating veins, the patient lies down and his leg is elevated to allow the blood to drain away from the varicose veins. A tourniquet is placed high on the thigh and the patient then stands up. If the varicosities fill up rapidly, within thirty seconds, it is assumed that there has been an overflow from the deep to the superficial veins. In other words the valves of the communicating veins are incompetent. This test has not much significance, because incompetence of the communicating vein is always associated with incompetence of the great saphenous veins and efficient sclerosis of the main vein will, in most cases, counteract the effect of the back-flow through the communicating veins. In a few cases failure to occlude a localized segment may be explained by this back-flow, and carefully localized injection should be tried and will probably prove successful. The main contra-indication to sclerosing therapy is occlusion of the deep venous system, for then the saphenous dilatation is compensatory. The patency of the deep veins is tested by occluding the superficial venous circulation by applying a gum-rubber bandage from the instep to just below the knee, or as high up the thigh as required. If the limb is depending on the superficial venous circulation the constriction of the bandage will cause severe pain when the patient tries to walk, and he will ask to have the bandage removed. In such a case sclerosis of the saphenous system must not be carried out.

MINISTRY OF HEALTH. **Memorandum on the Production of Artificial Immunity Against Diphtheria. (Revised Edition.)** Memo. 170/Med. 7 pp. 1940. London: H.M.S.O. [1d.]

LANCET. 1940, February 10, 273-4. **Diphtheria not prevented.**

In Part I of the Memorandum are set forth certain general considerations regarding pathology, epidemiology, transmission, and means of prevention, including those generally classified as administrative and those falling under the heading of artificial immunization. It is emphasized that diphtheria

is essentially a disease of children under 15 years and is the most common cause of death in children of school age, and that the advantages of immunization should be brought to the notice of all parents and guardians of children of over one year of age. In Part II the basis of acquired immunity is explained, the rôle of spontaneous immunization in bringing it about, how it may be measured by the Schick test, and how it may be stimulated artificially. In Part III the fact is stressed that though commonest in school life diphtheria shows its highest mortality in pre-school years. Therefore artificial immunization should form an integral part of the work of child welfare centres. The time taken to establish active immunity is mentioned and its duration is stated to be for years and perhaps for life. Since exceptions occur it is recommended that children immunized in infancy should be given a further dose of prophylactic on attaining school age. In Part IV practical recommendations, particularly with regard to the choice of prophylactics, are made. For children two doses of A.P.T. are recommended, one-shot immunization by inference not being recommended, and it is stated that in ordinary routine probably A.P.T. will be the prophylactic preferred. With regard to F.T. the curious remark is made that "where protection is urgently required and the necessary tests can be carried out, F.T. is the prophylactic of choice." When demands on the medical officer's time must be reduced to a minimum and reactions must be avoided even at the cost of somewhat lower immunity less quickly attained, T.A.M. or T.A.F. should be chosen. For nurses and busy adults T.A.F. should be employed as being less likely to produce local reactions. Re-Schicking two months or more after the last injection is recommended and those still susceptible should be given another course. Finally, a list is appended of the commercial firms supplying the necessary preparations and holding the Ministry's licence.

The *Lancet* underlines the importance of the subject in a leading article and stresses the fact that diphtheria if not prevented is of all our failures in our national health policy the most unforgivable. Progress in diphtheria immunization has been woefully inadequate and the writer finds difficulty in avoiding the conclusion that this is so principally because the public are ignorant of its benefits and because of lack of conviction within the medical profession, particularly among general practitioners. A. JOE.

Reprinted from "Bulletin of Hygiene," Vol. 15, No. 8.

Reviews.

THE PARASITES OF MAN IN TEMPERATE CLIMATES. By Thomas W. M. Cameron. Toronto: The University of Toronto Press. 1940. Pp. xi + 182. Price \$3.00.

This small volume written by the Professor of Parasitology of McGill University is mainly concerned with non-academic descriptions of the parasites of man that actually occur in North America or Great Britain and their eradication. The author indicates that the book is not intended for the specialist but rather for the general practitioner.

The book is divided into sections dealing with protozoa, helminths, and arthropods, but there is no account of classification and the arrangement within these sections is not in the usual zoological sequence. The book falls midway between a textbook on Medicine and one on Parasitology and it may appeal to certain practitioners who may wish to know more of parasitology than is taught in the normal curriculum. It would be difficult, however, for the average reader who has not had the advantage of previous practical knowledge of the subject to obtain an accurate picture of many of the parasites for the descriptions are not always sufficient, simple and clear. The treatment of conditions brought about by the presence of parasites known to be pathogenic is given full consideration and the drugs recommended are those in common use by the majority of practitioners. Many useful parasitocides are also described.

The book is very well produced; it contains some excellent illustrations and much information that is not commonly found in the more academic publications.

H. J. B.

INJURIES OF THE JAWS AND FACE, with special Reference to War Casualties. By W. Warwick James, *O.B.E.*, *F.R.C.S.*, *L.D.S.Eng.*, and B. W. Fickling, *F.R.C.S.*, *L.D.S.Eng.* London: John Bale & Staples Limited. 1940. Pp. xi + 200. 194 Illustrations. Price 15s., postage 6d. extra.

Ever since the war clouds burst over Europe, dental officers of the fighting and emergency medical services have wished for an up-to-date reference book on war injuries of the jaws, written from the essentially dental aspect by an author of extensive experience. The available literature on the subject, dating mainly to the last war, is limited, scattered and not readily accessible, while the valuable Report of the Army Advisory Standing Committee on Maxillo-Facial Injuries (1934) is confined by terms of reference to a brief outline of general principles. This book is, therefore, most opportune and the authors are to be thanked for a concise, practical guide, which should be studied by every dental officer and, with advantage, by all medical officers. It was a major dental tragedy of the Great War that the authorities, with the lapse of time, ultimately destroyed the case histories,

radiographs and photographs of the thousands of jaw cases treated at the various home hospitals when these closed down and it was a happy thought of Mr. James to preserve for future study some odds and ends of material of his cases at the Third London General Hospital, for the book is mainly based on his collection. Only those who have attempted to piece together disconnected notes, radiographs, models and appliances, frequently without identification and date, can truly appreciate the labour and patience required and the several months taken for the analysis of the material and preparation of the book are readily understood. Starting with organization, the specialized nature of the injuries and the necessity for trained particular teams to deal with them at the outset are stressed. The significant anatomical features which influence the character of the injury, its diagnosis and treatment, physiology of bone repair, radiographic technique and interpretation, are next considered, followed by the impact effects of missiles on the soft and hard tissues, with the types of wounds produced, a thorough understanding of which is essential for successful treatment. The bulk of the book is then given to emergency, preliminary and special treatments, so extensively illustrated and lucidly described that the whole sequence from time of wound is easily followed, and these will be the chapters most closely studied. So wide a field permits of much variation in operative and prosthetic procedure and techniques favoured by the authors are given due prominence though the alternatives are also considered. Eyelet interdental wiring is recommended whenever possible and there is no doubt it is coming increasingly into favour, especially in the preliminary stage. The illustrated appliances and supports for the hard and soft tissues are models of prosthetic ingenuity, skill and delicacy. Complications are outlined and effective treatment, including chemotherapy, described, while a chapter is given to the bone grafting technique developed at the Third London General Hospital, the book closing with a valuable statistical analysis of the material on which it was prepared. A particular feature which will be much appreciated is the large number (194) of illustrations, including several of cases twenty years after treatment. These are of the utmost instructional value and greatly enhance the practical guidance which was the object of this book's preparation and which will contribute markedly to its undoubted success. The general setting-up of the book is also a matter for compliment—large, clear type on excellent paper, subdivision into paragraphs with prominent headings, and large illustrations. Lastly, in these days of mounting costs of production, the price of fifteen shillings is reasonable. The success of this publication is assured and the demand for it should necessitate further editions.

S. H. W.

FRACTURES. By George Perkins, *M.C., M.Ch., F.R.C.S.* Oxford University Press. London: Humphrey Milford. 1940. Pp. ix + 384. Price 20s. net.

The tabulation of material and directness of style are features well suited to the student's requirements. The subject matter relating to

fractures of the limbs and vertebral column is excellent, being clear, precise and well illustrated by diagrams which have been arranged to appear opposite the text to which they relate. The section on fractures around the elbow is especially good and the reader will find an informative account in the general introduction of the changes which take place in the soft tissues and the methods of their treatment. G. M.

MINOR SURGERY. By R. J. McNeill Love, M.S., F.R.C.S. London: H. K. Lewis and Co., Ltd. 1940. Pp. viii + 370. Illustrations 155. Price 12s. 6d.

Mr. McNeill Love's small books are well known to students and nurses. He has now added to the series with a useful and well-illustrated small book intended primarily for surgical residents and the general practitioner who has time to do his own minor surgery. It is no easy task to confine the subject matter within the limits of what may be considered "minor" surgery, but on the whole the author has succeeded. It is good to find that he encourages "open dressings" for clean surgical wounds, and utters a warning against the tendency to rush in with a scalpel in treating septic infections.

D. C. M.

REGAIN YOUR FIGURE. HOW TO RECOVER THE FIGURE AFTER CHILD-BIRTH, WITHOUT "STRENGTHENING" EXERCISES. By Lieutenant-Colonel J. K. McConnel, D.S.O., M.C. London: Methuen & Co. Ltd. 1938. Pp. xii + 128. Price 6s. net.

Lieutenant-Colonel J. K. McConnel has put a lot of thought and, may one add, ingenuity into his book "Regain your Figure."

His interpretation of the word "Strengthening," however, does not quite fit in with the accepted meaning of the word. The book describes yet another method of arriving at the same result as many another system of physical exercises but to say that those that follow his advice can do so without "Strengthening" exercises or conscious effort is scarcely true to fact.

The book is primarily intended for women who have recently gone through the trials of childbirth. By stressing this point so much the author gives one the impression that child-bearing must of necessity (forbid the thought) ruin a woman's figure unless strenuous, even if unconscious, efforts are made to rectify the "damage" done by what should be a physiologically normal procedure. Following the old principle that prevention is better than cure, the author could greatly improve his book by applying his undoubted knowledge to the problem of assisting the expectant mother to retain her muscle balance before the arrival of her baby and thereby reduce the necessity of regaining it after the babe is born. Most of the theories expounded in the book are very sound. The methods explained for the rectification of faulty posture, etc., are good but in no way unique.

The majority of accepted methods of physical culture are devised on the principle of balanced muscle control. The diagrams are easy to understand. That the book gives sound advice as to a good and little fatiguing method of regaining muscle tone and consequently a feeling of well being, after a trying experience, and a return to the *status quo ante*, is an undoubted fact. It will be welcomed by many who have neither the time nor the inclination to indulge in an elaborate system of physical exercises. The system is equally useful for any one, man or woman, who is recuperating from an illness or disability which has necessitated a considerable period of inactivity.

J. D.

The following book has been received :—

FIELD AMBULANCE ORGANIZATION AND ADMINISTRATION. Revised and amended edition. By Lieutenant-Colonel James Hardie Neil, N.Z.M.C., late O.C. No. 3 N.Z. Field Ambulance. London: H. K. Lewis and Co., Ltd. 1940. Pp. viii + 128. 5s. net.

Correspondence.

THE TREATMENT OF THE SOLDIER'S FOOT.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

SIR,—The communication on the above subject by Major Arthur J. Helfet, R.A.M.C., in your May issue is a very timely one but there are one or two comments I would like to make regarding his remarks on the treatment of *hallux valgus*.

Hallux valgus in civil life is most commonly seen in elderly people and I consider that, in the soldier, one is usually dealing with the adolescent type of *hallux valgus* which is so often the result of *metatarsus primus varus*, the treatment of which is by no means satisfactory.

Major Helfet, I venture to state, has been very lucky in his patients. The majority of soldiers with this deformity have suffered little, if any trouble, in civil life. Ordinary military training associated with the wearing of the Army boot, the leather of which is not always softened by the soldier prior to wearing, leads him to report sick with this pre-existing deformity which has only caused discomfort since joining the Army. The patient is not always co-operative; he blames the Army boot, and I question very much if we can "fit every soldier's foot to the standard Army boot."

The late Mr. W. H. Trethowan used to state that in a case of bilateral *hallux valgus* one should only operate on a foot which is giving trouble. If one advised and operated on both feet, the foot which had caused no trouble before would invariably give the poorer result.

Here we are dealing with a patient who is inclined to feel that his trouble is due to the Army boot and to Army life generally. On leave, he wears his civilian shoes, which, in all probability, cause him no trouble. Can we, therefore, expect him to co-operate to the extent required in this orthopædic operation ?

I think the results of operative treatment in these cases are too uncertain to justify the time expended and I agree with the authorities who discourage such methods in the case of soldiers.

Yours, etc.,

HERBERT J. GREEN,
Major, R.A.M.C.

Notices.

"BENERVA" VITAMIN B₁ TABLETS (ROCHE).

ROCHE PRODUCTS LIMITED have put out new "tablets" of triple strength which are now available at the prices formerly quoted for 1 mg. tablets.

"Benerva" ampoules, formerly containing 2 mg., will be replaced by ampoules of 5 mg., and "Benerva" Forte ampoules, formerly of 10 mg. will in future contain 25 mg.

ORGAKININE.

THE Organon Laboratories, Ltd., send us the following account of their new preparation, Orgakinine.

Because quinine and vitamin C have both given good results in cases receiving no specific antiseptic therapy, we combined the two agents, as the quinine di-ascorbinate, Orgakinine; nearly 48 per cent of this is quinine and 52 per cent is ascorbic acid.

This quinine salt has the advantage of extreme solubility in water without the need to add any stabilizing substances.

Each 2 c.c. ampoule of Orgakinine contains 520 mg. of quinine di-ascorbinate: 250 mg. of quinine base, 270 mg. of vitamin C.

Each Orgakinine tablet contains 75 mg. of quinine di-ascorbinate: 36 mg. of quinine base, 39 mg. of vitamin C.

The use of a quinine-vitamin C therapy is particularly indicated where specific bactericidal therapy is withheld or has failed in lobar pneumonia, bronchopneumonia, influenza, colds.

In pneumonia: adults 2-3 ampoules daily by deep intramuscular injection. In a really early case it may be an advantage to give the injection intravenously.

In colds and influenza: 6 dragées a day, as 2 three times a day. In children the dose may be reduced in proportion to the age.

The preparation costs 2s. 6d. for 20 tablets, 10s. for 100, and 45s. for 500. Samples can be supplied on application.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

OBSERVATIONS ON CASUALTIES FROM THE WESTERN DESERT AND LIBYA ARRIVING AT A BASE HOSPITAL.

BY MAJOR G. A. G. MITCHELL, CH.M., MAJOR N. J. LOGIE, F.R.C.S.,
AND MAJOR R. S. HANDLEY, F.R.C.S.

Royal Army Medical Corps.

THIS article was inspired by a remark made by a medical officer that R.A.M.C. personnel working in forward and line of communication areas were anxious to know the results of their treatment. Between us we have seen almost seven hundred British and Italian casualties, men wounded in every region of the body, including many injured five to nine days before admission, and we have attempted to assess the value of varying types of treatment. Working under conditions of extreme difficulty and faced with problems of transport, supply, terrain and climate uncommon in other theatres of war, the medical officers in forward areas have achieved results which were admirable for the most part, as judged by the condition of the wounded on arrival at the Base. In certain cases, however, the measures adopted were less successful and it is from such that valuable lessons may be learned, lessons which emphasize that the canons of surgery can seldom be flouted with impunity. By selecting these cases we may apparently present a distorted review, but we have concentrated on the less successful results, not because we are actuated by the desire to criticize but because error rather than success is the great teacher. Incidentally medical officers would gain much useful information about the results of their treatment if they made more use of the official follow-up cards which are available.

FLESH WOUNDS.

Every case admitted had wounds of the soft tissues of varying severity, and many also suffered from damage to other structures. The less serious cases had had no treatment except one or more dressings, the favourite local applications being sulphanilamide and acriflavine, while all except a small minority had received prophylactic doses of anti-tetanic serum. Anti-gas gangrene serum was seldom employed.

The majority of the more serious wounds had been subjected to débridement or complete excision and the resulting cavities had been treated with sulphanilamide. Thereafter the procedure varied. Most of the wounds were left open but sometimes suture was attempted, sometimes the cavity was packed with plain gauze, and a few had been packed and partially sutured, an attempted compromise between open and closed treatments which usually failed. Undoubtedly those wounds which were left open did best. Examples of successful primary sutures were rarities, nearly all having become septic, so that the stitches had to be removed after arrival at the Base. The failures were due to incomplete or too late excision of damaged tissues, the presence of foreign bodies, tight suturing, insufficient drainage or lack of rest ; the liberal use of sulphanilamide did not neutralize the neglect of these cardinal points. Loose packs produced no ill-results and may have helped to keep the sulphanilamide in contact with the wound surfaces. Tight packing was encountered several times, mainly in wounds of the extremities, and usually with deplorable results. Pain was excessive, the wounds were septic, the general condition was often poor, and there was the added disadvantage that removal was often impossible without an anæsthetic.

The question of drainage is a difficult one and is closely related to the procedure adopted after cleansing the wound but we believe that certain primary sutures would have succeeded had a separate drainage incision been made in the most dependent position, through which a jaconette or rubber drain could have been inserted. Drainage tubes were seldom employed and counter-incisions were conspicuous by their absence—not a surprising fact, for an infected area requiring such incisions on reaching the Base may well have had adequate drainage through the original wound when last treated. It was found that gauze packing was worse than useless as a method of draining sutured wounds on account of coagulation of the enmeshed exudate ; well-vaselined gauze strips are more effective as drains than dry gauze, provided the suturing is not too tight.

A number of attempts had been made in forward areas to remove foreign bodies before radiography was possible and a high proportion of these operations were failures. Therefore unless a foreign body can be seen or felt, or is producing severe symptoms, it is unwise to attempt its removal until accurate localization has been effected and foolish to do a primary suture after such an operation unless all corners of the wound have been inspected.

This is especially true in areas where the presence of important structures or large muscular masses renders exploration difficult or dangerous.

When there are extensive or multiple wounds the advantages of splinting might be considered more frequently, and if tendons or nerves are severed the limb should be maintained by splints in the position most favourable for repair. This important principle of surgery was neglected in several cases and employed with excellent results in others.

HÆMORRHAGE.

We have mentioned that tight packing of wounds produced deplorable results. Such packs were doubtless inserted to procure hæmostasis and, were the journey between the various medical stations of short duration, no harm might result but, when days may elapse between their insertion and removal, this method should be avoided.

Realizing the difficulties of searching for a divided vessel when working in unfavourable surroundings, perhaps with inadequate instruments and defective lighting, we suggest that if a bleeding point cannot be secured and tight packing is used as a last resort, then the fact should be prominently noted in the Field Medical Card so that the packing can be removed at the first place where reasonable surgical facilities exist. In palmar wounds, where prolonged packing is particularly undesirable, the relative safety of arresting hæmorrhage by a palmar pad and a firm bandage over the clenched fist is worth remembering. The bandage can be slackened and readjusted by an orderly whenever necessary, whereas the pressure of a pack cannot be eased so simply. Incidentally, the search for bleeding points would be greatly facilitated if small self-retaining retractors were included in surgical haversacks and operating sets.

No cases were admitted wearing tourniquets but a few arrived in whom layer after layer of bandages had been firmly applied to a limb to control hæmorrhage. These had become saturated with dried blood and formed a rigid case constricting the limb, producing severe pain locally and œdema of the parts distally. If exploration and direct control of bleeding is impossible, then the lesser of two evils is the use of a pack rather than of layers of bandages.

Severe grades of anæmia were uncommon but several patients would have benefited from blood or plasma transfusions before being sent down the line.

CHEMOTHERAPY.

Chemotherapy was used frequently, sulphanilamide or sulphapyridine being given orally, applied locally to the wound, or the two methods were combined.

The dosage given by mouth varied considerably and the regularity of administration fluctuated as the patient passed from stage to stage of the journey. Calculations made from Field Medical Cards and other

documents showed that the amounts given were usually between 1 and 4 grammes daily—seldom more and often less. From a study of the condition of the cases on arrival at the Base we are convinced that those who received the larger doses of the drug showed less local sepsis and had fewer complications and we therefore believe that larger doses should be given orally as a routine and that local applications of sulphanilamide are also advisable because they provide a greater concentration of the drug in the vicinity of the infecting organisms. Oral administration should never be omitted, because local applications may be washed out of the wound if the discharge is profuse or the drug may all be absorbed and excreted within sixty hours. We are fortunate in having Major G. A. H. Buttle as a colleague, and after careful consideration of many cases we are in agreement that the present dosage recommended in official memoranda for the prophylaxis of wound infection is inadequate and we suggest that all wounds should be dusted with finely powdered sulphanilamide as soon as possible after wounding. The amount to be used must obviously depend on the size or number of the wounds, but the total applied should not exceed 15 grammes at one time. A further local application of a similar amount should be made in all severe injuries when surgical cleansing of the wound(s) is undertaken. Such applications would be greatly facilitated if medical officers and units were provided with cellophane packets or tubes each containing 5 grammes of finely powdered sterile sulphanilamide. Such packets might actually be enclosed in the first field dressing. Oral administration consisting of 3 tablets (1.5 grammes) thrice daily should commence as soon as possible, and certainly within twenty-four hours of the occurrence of the casualty, and should be continued for six days. The dates, times and the dosages given should be carefully recorded in the Field Medical Cards. In practice, as we have said, the doses were given sporadically and, in order to ensure regularity, a characteristic label might be provided which could be attached in a conspicuous position to men selected by medical officers for chemotherapy. Thereafter, wherever the man might go and by whatever method of transport the fact would be patent that he was receiving sulphanilamide and an orderly could go round at stated times with a supply of the drug, give 3 tablets to each man wearing the label, and at the same time record the fact by marking the card with an X in the appropriate place. It is simple to devise a printed label which reduces writing to an absolute minimum (figs. 1 and 2).

If serious infection supervenes, or if the wound is already infected when the man is first seen, then larger doses are required, for example 5 to 6 tablets every six hours (10 to 12 grammes daily) for the first two days, the dose being gradually reduced as the condition improves. Such doses were never given before admission even in severe cases. Should gas-gangrene develop or be suspected, sulphapyridine should be given instead of sulphanilamide because, although both act against *Cl. welchii*, the former is slightly more active against the *Cl. septicæ*. These larger doses are potentially

complications due to hæmolytic streptococcal infection can develop in patients receiving 8 grammes sulphanilamide daily.

As regards local applications sulphanilamide apparently produced better results than such antiseptics as eusol, acriflavine or hydrogen peroxide, and this was particularly noticeable in cases where the dressings had not been changed for three days or more. Under such conditions those treated with the usual antiseptics were often heavily infected, whereas those dressed with sulphanilamide were often surprisingly clean. Those wounds which had not responded so well to sulphanilamide were found to be infected with staphylococci—usually *S. aureus*.

Whether or not the best method of applying the drug locally has yet been found is questionable. Application to deep or complicated cavities is always difficult, for example to the knee-joint or to large wounds made by modern missiles where the underlying damage is often so much more extensive than the size of the superficial wound would lead one to expect. In cases arriving at the Base it was found that in superficial wounds the powder was more adherent to the dressings than to the raw surface and was removed with the soiled dressings while, in many cases, it was apparent that incompletely crushed tablets had been used both for surface application and for insertion into cavities. Thus in cases with deep wounds irregular masses were found to be extruding from the cavities and sulphanilamide in this lumpy state can scarcely be expected to exert its maximum effect.

In co-operation with Major G. A. H. Buttle we have been experimenting with various methods which could be employed in forward and line of communication areas. For example in surface wounds sulphanilamide may be used as a fine powder applied evenly under a vaseline spread (in our opinion the best method); as an ointment (5 grammes sulphanilamide to one ounce vaseline) applied directly to the wound or spread on gauze or lint; in the form of a solution containing 5 per cent sulphanilamide, 20 per cent dextrose and 4 per cent sodium bicarbonate, in which the dressings may be soaked or which may be sprayed on the wound, left for ten to fifteen minutes, and then covered by a vaseline spread. This last method produces a thin adherent film of the drug over the entire wound area. For deep cavities and complicated spaces a solution containing 5 to 8 per cent sulphanilamide in 80 to 100 per cent glycerine provides an easy method of introducing the drug to every recess and it also makes an almost non-adherent dressing for more superficial wounds.

FRACTURES.

Very few fractures had been missed. All others had been treated in orthodox ways, and the great majority arrived in excellent general condition. Most of the fractures were compound and comminuted and many were complicated by involvement of joints, vessels or nerves. Nearly all these had been operated upon and fixed in wooden, wire, or improvised splints, in plaster or, in the case of fractured femora, in Thomas' splints. The few

who arrived in poor condition had other injuries, usually visceral, or their wounds had become heavily infected.

The results being generally so effective, we have little to offer in the way of constructive criticism. Plaster of Paris, the best form of support for most limb fractures, might have been used more often and, when it was employed, the casings were sometimes too short or too thin for adequate support although this may have been due to a scarcity of plaster in the forward areas. The use of plaster slabs was not sufficiently appreciated. These can be held in position by a few circular turns of a plaster bandage, the result being a case very thick and strong in one sector to give adequate support, and so thin elsewhere that it may be cut with ordinary scissors should the need arise (actually we saw no instance of damage from too tight a plaster). Plaster splints composed entirely of circular turns are less strong, weight for weight, than those employing the girder principle, and their uniform thickness precludes their easy removal without special instruments. The slab method, therefore, not only saves plaster but also possesses definite advantages over the circular method of application. When removal of the case is likely to be required within two or three weeks, vaseline smeared over the skin prevents adhesion of the plaster to the hairs, thus avoiding what we found to be a common cause of pain and inconvenience. In addition if an open infected fracture exists vaseline helps to protect the skin from secondary infection.

Men with fractured femora had their injured limbs fixed in Thomas' splints but extension was usually omitted. No spring boot clips were in evidence and we conclude they are not available; the alternative clove-hitch and windlass method was only seen once. The limbs were well fixed, so no great shock had resulted but, nevertheless, extension is desirable though heavy traction is not required to enhance the efficiency of the fixation. Cases have been reported where a tightly applied clove-hitch had caused sloughing and, during the long journey from the desert front, this would have been very liable to occur. Some such thought may have been in the minds of the medical officers who neglected this method of extension. The rings of the splints often bore no relationship to the size of the thigh, and the provision of splints with adjustable rings or detachable rings of varying sizes would be a useful addition to the medical equipment. Colonel Monro, Consulting Surgeon, M.E.F., has suggested that in fractures of the lower limb the use of posterior plaster slabs, with plaster bandage ties incorporating the side bars of a Thomas' splint, would give better fixation than the splint used alone. In two cases where we saw this method employed—one an officer with a compound fracture of the femoral condyles and the other a serjeant-pilot suffering from a fracture-dislocation of a knee—the results were excellent and the method deserves wide adoption.

Those with fractures in the region of the knee-joint or of the leg bones were more comfortable in plaster cases than in Thomas' splints alone. Tightly laced boots were a source of discomfort in several cases and if the

boots are not removed the laces should be cut. Of cases with fractured humeri some had splints and some had none but all wore wide or narrow fold slings and a few had the arm bound to the side by a binder, an arrangement which proved most comfortable.

The battle casualties with fractured ribs or pelvis had penetrating or perforating injuries of the chest or abdomen and those with fractures of the skull or vertebral arches had evidence of damage to the brain or spinal cord. The visceral lesions overshadowed the symptoms and signs of the fractures and no treatment of the bony injuries had been attempted. Three cases with fractures of vertebral bodies arrived without evidence of cord lesions, having been handled and transported correctly.

Only two men with severe cervico-facial injuries were admitted. One, who had had one side of his face and neck blown away nine days before, with great maxillary and mandibular destruction, could swallow nothing except small amounts of fluids and was slowly starving. A gastrostomy led to temporary improvement until a fatal bronchopneumonia supervened. He might have survived had a gastrostomy been done at an earlier stage. The other case was less severe, deglutition was scarcely affected, and he did remarkably well after wiring of the mandible and secondary suture.

AMPUTATIONS.

No amputation case arrived in good condition, this being due to various factors but particularly to insufficient general and local rest following operation. Some evacuated soon after operation died before they reached the Base and the others exhibited various degrees of surgical shock. When rapid evacuation of amputation cases is imperative, the journey may be made more tolerable if a plaster cap is applied which can be removed and replaced like a finger cot. Such caps keep dressings in position, minimize swelling, give support to the stump, and protect it from the minor traumata incidental to transport. The removal of the cap is facilitated if in the first place the skin is smeared with vaseline or covered with thin vaseline-gauze spreads.

Owing to skin destruction and other causes amputations in war casualties cannot always be performed at the sites of election and unorthodox skin flaps or shortish stumps may be unavoidable, but too long stumps and too tight suturing of skin flaps are avoidable. We saw one case of Syme's amputation where sepsis had supervened with partial sloughing of the heel flap. Secondary hæmorrhage occurred ten days after the initial operation necessitating reamputation through the leg. As it is more difficult to fashion a prosthesis for a Syme's amputation than for one at the site of election, should not the former method be discarded?

Men with guillotine amputations were all dangerously ill on arrival. They all had severe pain, their wounds were heavily infected, the stumps were acutely tender, and loss of serum was a pronounced feature. A

guillotine amputation is necessary only in the gravest cases ; in the others the few extra minutes required to fashion and loosely suture short skin flaps may increase the operative risk slightly but this is more than counter-balanced by the greater safety and comfort of the subsequent journey. This lesson was clearly impressed upon us by a comparison of the various types of amputation. The increasing availability and use of blood and plasma will greatly reduce the necessity for extreme haste.

The mention of haste raises another problem. Two men were admitted with guillotine amputations performed through the head of the tibia, about two inches below the joint, almost the thickest part of the bone. As re-amputation would clearly be required, disarticulation through the knee would have been easier and would have meant less hæmorrhage, less shock, less subsequent loss of serum, less pain, and less septic absorption from the largely cartilaginous and tendinous raw areas left, while short skin flaps might have been fashioned from the skin which in both cases was intact at the level of tibial section. The moral is this: disarticulation should be performed in every case where a guillotine amputation would otherwise be necessary immediately below the elbow or the knee.

Skin retraction in guillotine amputations always occurs and some form of skin extension is essential ; otherwise the surgeon who reamputates may have to sacrifice more bone than is desirable. This extension should be applied at the time of operation and U-shaped elastoplast straps fixed over the stump dressing do much to counteract shrinking ; thereafter a plaster cap can be applied. A more elaborate method is to fix elastoplast extensions to the skin, apply the appropriate Thomas' splint and tie the strapping under tension to the side bars or end-piece.

One last point, interesting though not strictly apposite, may be interpolated here. Four men with amputations had a note in their Field Medical Cards to the effect that the ablations had been performed for "gangrene," and anti-gas-gangrene serum and sulphanilamide had also been given. Anaerobic infection, therefore, was either diagnosed or suspected. If they were suffering from gas-gangrene the recovery rate contrasts forcibly with our experience of similar cases treated days later at the Base where only one of six proved cases survived—sad confirmation of the dangers of delayed treatment in these infections.

WOUNDS INVOLVING THE BODY CAVITIES.

Cases with spinal and cranial injuries withstood the ordeal of the journey better than those suffering from wounds of the other body cavities. One case with a hernia cerebri had signs of a meningo-encephalitis, but whether he contracted the infection at the time of injury or later it is impossible to tell ; three other similar cases arrived in good condition. A soldier, paraplegic from the sixth thoracic segment downwards, had required frequent catheterization and had developed a severe cystitis and urethritis. Quite

apart from the danger of infection, instrumentation is a difficult matter during transport, and an early suprapubic cystostomy helps to circumvent both these problems. Instructions could be given to an orderly *re* regular emptying and absorbent dressings would minimize the risk of bed soiling and consequent skin irritation. Protection of anæsthetic skin over pressure points such as the sacrum and heels is imperative, a pad of wool retained in position by bandages or adhesive plaster being efficient ; strapping alone does much to prevent direct friction, but may itself produce skin irritation. Two paraplegic cases had sacral pressure sores and one a heel sore which had not been treated before admission.

Men with penetrating and perforating abdominal and chest wounds should not be sent further than is absolutely necessary as, in our experience, they travel badly. Twenty chest and eleven abdominal cases which were admitted were all seriously or dangerously ill. The most careful selection should be made before men with such injuries are subjected to a prolonged and at the best of times trying journey. A true assessment of the progress of such cases, favourable or unfavourable, can only be made by constant observation, preferably by the same person, and this is a sound reason for retaining these cases as long as possible at the first point where a surgical team is located. It is courting disaster to send soldiers with abdominal wounds straight to the Base, even those which are apparently simple, for it is axiomatic that any wound of the abdominal parietes should be treated as a wound involving the peritoneal cavity until this can be definitely disproved. The following two cases illustrate this point : one man had an intestinal obstruction as a result of a small perforating abdominal wound five days before and another with a similar injury had developed a general peritonitis and ileus. We have been able to verify the already well-established facts that the size of an entry wound may bear no relationship to the amount of internal damage and that wounds of the buttock, groin and perineum are often complicated by injuries to abdominal or pelvic viscera or to the urethra. The danger of overlooking a ruptured urethra was well exemplified in a man who was found on arrival to have widespread extravasation of urine from such a lesion with gangrene of all the superficial tissues of the perineum and genitalia ; he died a few days later from secondary hæmorrhage. Recovery might have occurred had an early suprapubic cystostomy been performed and free drainage provided at the site of extravasation.

The remarks about abdominal cases apply with almost equal force to chest injuries and the fact that wounds of the root of the neck or shoulder regions are liable to be accompanied by intrathoracic lesions was sometimes forgotten. Several men who arrived with large accumulations of blood or sanio-pus in a pleural cavity would have suffered less cardiac and respiratory embarrassment had a paracentesis been performed before evacuation. This procedure may tend to restart hæmorrhage but this danger can be averted by air replacement and by retaining cases for twenty-four to forty-

eight hours after paracentesis. It would then be easy to determine whether fresh bleeding had occurred and if not the subsequent journey could be made in relative comfort and safety. One man with a sucking pneumothorax came under observation with such overwhelming infection of the pleura and parietes that he was beyond surgical aid.

This article was written before we knew that an Official Memorandum (M.E. Technical Instructions, 1941, No. 3—War Surgery) was in the course of production and it is significant that, broadly speaking, the conclusions are similar, although the Memorandum deals chiefly with experiences in other theatres of war.

We wish to express our thanks to Colonel H. J. A. Longmore for permission to forward this article for publication and to our medical and nursing colleagues on the staff of the Hospital who have helped us in innumerable ways in the treatment of our cases. We are especially indebted to Colonel Monro, Consultant in Surgery, G.H.Q., M.E., for much helpful criticism and advice.

INTENSIVE TREATMENT OF GONORRHOEA AND NON-SPECIFIC URETHRITIS WITH SULPHAPYRIDINE.¹

BY LIEUTENANT-COLONEL A. J. KING,

Royal Army Medical Corps.

AND

MAJOR D. I. WILLIAMS,

Royal Army Medical Corps.

THE effectiveness of sulphapyridine in the treatment of gonorrhœa has never been seriously questioned. From the first results were universally good and led naturally to a spirit of extreme optimism which has now given place to the realization that there are problems still to be solved, not the least of which is the difficult problem of dosage. From the many and varied schemes of treatment which are used it is clear that there is no general agreement as to the routine dosage which will produce the highest proportion of good results while yet avoiding undue toxic effects. Most workers in the subject now stress the importance of a high constant level of blood sulphapyridine maintained by giving larger doses at first followed by smaller doses at short intervals ; and certainly the general experience is that to give small doses at first is to risk disaster in the form of the resistant or "sulphonamide fast" case. Bowie, Anderson, Dawson and Mackay (1939) were the first to record their experiences with massive initial dosage followed by rather large doses over a short period. In the course of review of experience with various schemes of dosage they described the effects on 23 men with gonorrhœa of the following treatment :

4 grams of sulphapyridine at once, 2 grams of sulphapyridine after four hours, then 1 gram every four hours during the waking periods, the total dosage spread over seventy-two hours, making a total of from 15 to 20 grams. This has been called the "8—4—2" treatment, from the number of tablets administered at successive intervals, and also the "Aberdeen method." Treatment given by this or similar schemes will be referred to in this paper as "Intensive Treatment." Of the 23 patients in this series twenty were cured without further treatment and one was probably so cured. In this group there was a high incidence of unpleasant although not serious toxic reactions and, although these patients were actually treated as out-patients, the desirability of strict control of such treatment under in-patient conditions is clear. This probably accounts for the fact that there are few records in the literature of the use of this treatment. It was to be anticipated that a method which, under conditions of strict observation and control, promised to give rapid and efficient results would be of considerable interest to the fighting services and, in fact, the other two publications which we have traced

¹ A paper read to the Medical Society for the Study of Venereal Diseases in London on March 25, 1941.

came from this source. Buist and Simon (1940) treated 20 men suffering from fresh uncomplicated gonorrhœa according to the scheme of dosage outlined above. All responded to the treatment and the average length of stay in hospital was 5·3 days. During periods of observation, and tests varying from two to three months, one relapse occurred.

Petro (1940) treated 100 patients, 27 of them with a course almost identical with that first used by the Aberdeen school, in which the period of treatment was seventy-two hours and the tablets were given during the day only, the total sulphapyridine in each case amounting to 16 grams. The remaining 73 received a preliminary dose of vaccine consisting of twenty million gonococci, given intradermally, followed by a course of sulphapyridine consisting of 4, 2, 1 grams at intervals of four hours and then one gram four-hourly day and night for a total of forty-four hours. The amount of sulphapyridine administered in each case was again 16 grams. In the first group the average time taken to achieve clinical cure was 9·07 days. Three failed to respond but, in a follow up period of two months, there were no relapses in the successful cases. In the second group the average time before clinical cure was 6·7 days; two failed to respond and there was one relapse after apparent success. Toxic manifestations were of a minor character except in two cases, in one of which hæmaturia occurred and in the other renal colic with microscopic evidence of blood and crystals in the urine. In both cases the symptoms subsided promptly when the drug was discontinued. Failures were attributed to faulty drainage resulting from narrow external urinary meatus, from "pocketing" of infection in Littré's glands or from urethral stricture due to past infection.

DESCRIPTION OF CLINICAL MATERIAL.

In our series the total number of patients treated intensively was 502 including 397 whose urethral smears showed gonococci and 98 in whom the gonococcus was not found. Seven were suffering from infections such as cystitis which are not relevant to the present investigation.

Of the 397 patients with gonorrhœa 16 had had recent gonorrhœa treated with sulphonamide preparations and were presumed to have relapsed. Thirty-nine others gave the history of an attack of gonorrhœa in previous years. Five had received small doses of sulphonamide preparations before admission to hospital; but the dosage given was insufficient to produce any beneficial effect and all continued to show gonococci in smears.

Of the 98 patients diagnosed as suffering from non-specific urethritis 20 admitted to a previous attack of gonorrhœa and 10 to previous attacks of non-specific urethritis. One had had inadequate treatment with sulphonamide before admission. Most of the men in this group admitted having taken a risk of infection.

Almost all these patients reported sick at once when symptoms appeared and were immediately admitted to hospital for treatment. Of 397 men with gonorrhœa only 31 had had symptoms for more than one week. Of

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98 men with non-specific urethritis 14 had had symptoms for more than a week. The remainder in each category had noticed symptoms for periods varying from a few hours to seven days, but in the large majority treatment was instituted within the first three days.

Under these circumstances the number of patients with complications before treatment was started was small, as might be expected.

Among the patients with gonorrhœa there were : 6 cases of epididymitis ; 1 infection of Tyson's gland ; 1 infection of a para-urethral duct.

Among the patients with non-specific urethritis there were : 5 cases of epididymitis ; 1 case of fibrositis.

DETAILS OF TREATMENT.

The broad outlines of our scheme of treatment remained unchanged throughout the four months in which we used this intensive course but as our experience of the toxic effects of the drug grew a number of modifications were made. From the first all patients were kept strictly in bed, during the seventy-two hours in which they were taking sulphapyridine, on a "milk diet" consisting of two to three pints of milk daily with rice, bread and butter or margarine. Temperature was taken morning and evening. In 402 cases an initial dose of 8 tablets of sulphapyridine was followed by 4 tablets in four hours' time and thereafter by 2 tablets every four hours day and night to the seventy-second hour when the last dose was given—a total of 23 grams. 100 patients were treated by an 8—6—4—2 tablets scheme; a total of 25 grams. In all cases the actual taking of tablets was supervised so that doses could not be missed. In most cases the tablets were swallowed whole and a large drink of water given immediately afterwards. It was soon evident that as far as the patient was concerned the most troublesome effect of the treatment was the high incidence of vomiting. The suggestion was made that constipation might be a predisposing factor and therefore, in all later cases a "No. 9" pill, consisting of calomel grains ii, compound rhubarb pill grains ii, compound colocynth pill grains ii, was given at the beginning of the treatment. It seemed that the incidence of vomiting was slightly less in consequence. At first the possibility of severe damage to the bone marrow was feared and daily white cell counts were done. Later the cell count on the second day was given up, and finally a count was done on the third morning of treatment only unless there was some special indication at another time. Early morning smears and urine were examined daily during treatment. No urethral irrigations or other local treatments were given.

The incidence of certain renal complications—to be discussed later—brought in its train further additions to the routine. The daily fluid intake and output were measured, alkali was given by mouth, at first in the form of sodium bicarbonate, 1 drachm to the pint of water, in as large quantities as the patients could be persuaded to take (Long and Bliss, 1939)—and later as potassium or sodium citrate grains xxx two-hourly throughout the twenty-four hours since sodium bicarbonate of itself seemed to encourage

vomiting in some cases and was so unpalatable that difficulty was experienced in ensuring that it was taken in adequate quantities. Patients were of course examined daily and carefully questioned as to abdominal symptoms, particularly pain. The urine was watched for macroscopic and, in certain cases, for microscopic evidence of blood.

PROCEDURE FOR OBSERVATION AND TESTS OF CURE.

At the end of the three-day course of treatment patients were allowed up and were usually fit to perform light ward duties. After treatment close observation under in-patient conditions extended over a period of at least seven days and longer if there was doubt about clinical cure. In each case on three or four occasions during this period an attempt was made to obtain and examine a urethral smear before the first morning specimen of urine was passed. At the same time the first morning specimens of urine were examined by naked eye and the persistent presence of leucocytes in the smear during the period of observation, or of haziness or pus threads in the urine, was accepted as evidence that cure was not complete and that further observation or treatment was required. The repeated naked-eye examination of such all night specimens of urine by the experienced observer, supported by microscopic examination of threads when necessary, is probably the most reliable of all single tests for latency of gonorrhœa. This test is still more reliable if alcohol is taken beforehand. If at the end of seven days morning smears and urine were satisfactory the following tests were performed :

- (1) Rectal examination.
- (2) Microscopic examination of a prostatic bead.
- (3) Naked-eye examination of the urine after the prostatic massage.
- (4) Urethroscopy.

These tests were followed by another examination of morning smear and urine on the day after instrumentation. If all the tests were satisfactory the patient was discharged from hospital.

Arrangements were made with the man's unit for him to attend at hospital once a week for three weeks for urethral and prostatic smear and for examination of the urine. Finally, three months after discharge from hospital, each patient was re-admitted and all tests repeated with the addition of a complement fixation test for gonorrhœa on the blood-serum. If the tests remained satisfactory the patient was discharged as cured.

The difficulties of maintaining these standards under war-time conditions are obvious. Units are moved from place to place, from Command to Command and overseas. As far as possible these men have been followed through their period of three months' observation but there are large gaps in the information and these will be indicated. It may be argued that three months is too short a time for observation in view of the fact that relapses after treatment with sulphonamides have been described after longer intervals. The force of this criticism must be admitted but it is not possible

to provide for every contingency in a disease so variable in its outcome as gonorrhœa and, probably, the standards of observation and testing were as high as could be attained in the circumstances. The question of relapse is in any case a difficult one. No method of hard and fast distinction between relapse and reinfection has yet been devised. Histories are misleading and even the certain knowledge that sexual intercourse has taken place is no sure evidence that reinfection has occurred. It is well known that intercourse is one of the common factors which may convert latent into declared infection.

IMMEDIATE RESULTS OF TREATMENT.

For the purpose of assessing the effectiveness of this scheme of treatment in producing clinical cure each group is divided into three sub-groups according to the amount of treatment ultimately required and in each sub-group the average length of time that these patients were detained in hospital is indicated. This last is in many respects an inaccurate index of the success or failure of this treatment. In using a scheme of dosage with which we were unfamiliar it was a natural tendency to prolong rather than to shorten the period of observation. This also depended to a great extent, as it proved, upon the view of the individual medical officer. The facts that these men were drawn from a large and scattered Command and that units were often situated many miles from the Command treatment centre, had to be taken into consideration and demanded longer observation than would have been necessary in a compact area.

The sub-grouping is as follows :

Gonorrhœa.—The total number of patients was 397.

(1) Patients requiring no further treatment after three days' intensive treatment numbered 195, or 49 per cent of the total. The period of stay in hospital varied from 11 to 28 days, the average time being 13 days.

(2) Patients requiring a small amount of extra treatment such as one intravenous injection of T.A.B. vaccine or urethral irrigations for a few days only. These numbered 60, or 15 per cent of the total. In-patient stay varied from 15 to 38 days and the average was 23 days.

(3) Patients requiring a further course of sulphonamide irrigations and T.A.B. combined, or other combinations of these treatments, numbered 142 or 36 per cent of the total. Five of these patients in sub-group 3 are still in hospital after treatment for periods of from 83 to 110 days. The remaining 137 were in hospital for an average time of 44 days, the shortest period being 18 days and the longest 114 days.

“*Sulphonamide Resistance.*”—Fourteen patients in this series were suffering from infections which proved “sulphonamide resistant” in that gonococci were still present in the urethral secretions when the intensive course of treatment was finished and persisted for variable periods from the fourth day up to three months. Bowie and his co-workers state, in their original article that, in a few cases, gonococci were present in a mucoid secretion at

the end of intensive treatment but disappeared at once, the patient making a prompt and satisfactory recovery. In our series this occurred in only one case, which is included in the first and most satisfactory group, since no further treatment was required and the patient was discharged from hospital after fourteen days. One other made a prompt recovery after an additional intravenous injection of T.A.B. and is included in the second group. The remaining twelve were very resistant and required prolonged treatment. They are included in the third group and one is among the five patients still in hospital.

COMPARISON WITH PATIENTS SUFFERING FROM GONORRHOEA AND TREATED WITH A ROUTINE NON-INTENSIVE COURSE.

For the purposes of this comparison the records were taken at random of an identical number of cases, 397, treated with a fourteen-day course of sulphapyridine consisting of 4 grams daily for three days followed by 3 grams daily for eleven days without irrigations. The standards of observation and tests were identical. The following is the result of assessment of these cases under the same headings :

(1) 198 or 50 per cent required no additional treatment. The length of stay in hospital varied from 12 to 37 days and the average was 30 days.

(2) 62 or 16 per cent required a small amount of additional treatment. Stay in hospital varied from 14 days (in a patient whose course was curtailed through toxic effects) to 29 days. The average length of stay was 20 days.

(3) 137 or 34 per cent required considerably more treatment. Stay in hospital varied from 20 to 223 days, with an average of 56 days. 26 of these cases, all included in sub-group 3, proved "sulphonamide fast."

NON-SPECIFIC URETHRITIS TREATED INTENSIVELY.

The total number of patients was 98, of which two became seriously ill as a result of treatment, one with fatal outcome, and are not included in this assessment.

(1) 27 or 28 per cent of the total (96) required no additional treatment. The length of stay in hospital varied from 9 to 23 days and the average was 13 days.

(2) 7 or 7 per cent required a small amount of additional treatment. Stay in hospital varied from 18 to 30 days, and the average was 23 days.

(3) 62 or 65 per cent required considerably more treatment ; for 57 of these the stay in hospital varied from 20 to 112 days and the average was 48 days. The other 5 are still in hospital after 75, 83, 100, 105 and 124 days respectively.

COMPARISON WITH PATIENTS SUFFERING FROM NON-SPECIFIC URETHRITIS TREATED WITH ROUTINE NON-INTENSIVE COURSE.

The records of 98 patients with non-specific urethritis who had received the routine fourteen-day course without urethral irrigations were taken at random.

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(1) 34 or 35 per cent of the total required no additional treatment. Stay in hospital varied from 15 to 32 days and the average was 21 days.

(2) 6 or 6 per cent required a small amount of additional treatment. Stay in hospital varied from 20 to 32 days, the average being 26 days.

(3) 58 or 59 per cent required considerably more treatment. Stay in hospital varied from 32 to 130 days ; the average was 60 days.

THE EFFECT OF DURATION OF THE INFECTION UPON THE RESULTS OF TREATMENT.

As previously stated the very large majority of these men began treatment during the first week following the onset of symptoms. Those with discharge for more than one week were only 27 in number and fall into the appropriate sub-groups as follows : (1) 14 or 52 per cent ; (2) 2 or 7 per cent ; (3) 11 or 41 per cent.

The average time of stay in hospital for all these cases was 27 days. Obviously conclusions cannot be drawn from this small number of cases but, for what the evidence is worth, there appears to be no difference between this group and the majority.

COMPLICATIONS OF INFECTION ARISING DURING TREATMENT.

Gonorrhœa Treated Intensively.

The following complications occurred : 1 case of epididymitis supervened on the third day, 1 case of arthritis of knee on the fourth day, 1 case of multiple arthritis on the seventh day and 1 case of latent prostatitis was discovered as the result of tests for cure.

Control Cases of Gonorrhœa.

There were 9 cases of soft stricture of the urethra and in one case a fibrous stricture was found at final test five months later in a man with no history of previous gonorrhœa. In addition there was one case of periurethral abscess and one of epididymitis occurring on the eighth day.

Non-Specific Urethritis Treated Intensively.

The following complications occurred : 1 case of subacute prostatitis occurring after 2½ months ; 1 case of arthritis of the knee on the tenth day ; 1 case of epididymitis in the seventh week ; 1 case of multiple arthritis beginning on the fourth day.

Control Cases of Non-Specific Urethritis.

Soft strictures were found subsequently in 5 cases ; there was 1 case of epididymitis on the sixth day and also 1 case of metatarsalgia on the eighth day.

Local Results of Treatment.

The difficulties of carrying this investigation to its ultimate conclusion have been indicated. As regards control patients it has been impossible

to obtain figures which would be of any value. Every effort has been made to obtain details of the later history of patients treated with the intensive method. Many are serving overseas and details are not yet available. Others did not start their treatment until the end of December and early January and, at the time of writing, are not yet due for their final tests. Of the patients with gonorrhœa 127 are known to have passed all their tests satisfactorily—78 from group (1), 19 from group (2), and 30 from group (3).

Of the patients with non-specific urethritis there are records of 22, 9 in group (1), 1 in group (2), and 6 in group (3), who have passed all tests.

Relapses.—From the group of patients with gonorrhœa 21 are known to have relapsed. Of these 15 were in group (1), 7 of these having positive smears; 1 in group (2), having a positive smear; 5 were in group (3), 2 of these having a positive smear.

From the cases with non-specific urethritis, 1 from group (1) is known to have relapsed and 2 from group (3).

These results are still coming in and the ultimate assessment will include a considerable proportion of the total number treated.

THE COMPLICATIONS OF TREATMENT.

Minor Toxic Effects.—Most of the complications were of a minor character although unpleasant and often distressing to the patient. These occurred in the following order of frequency: vomiting, headache, nausea and feeling of distension, anorexia, persistent low backache, insomnia, depression, leucopenia, skin rashes. Vomiting was the only symptom of this character which assumed important proportions. It occurred in more than 60 per cent and in half of these it was severe enough to cause considerable distress and to handicap treatment. Nevertheless, in no case was treatment stopped on account of it. The administration of alkalis in the form of sodium bicarbonate, 1 drachm to the pint of water, or of potassium or sodium citrate grains xxx two-hourly, seemed to control vomiting to some small extent. All patients were free from these minor complaints within twenty-four hours of the termination of the treatment.

White cell counts did not fall below 5,000 per c.mm. in any case; but in one instance in which the total count was 5,200 per c.mm. the percentage of polymorphonuclear leucocytes fell to 43 and it was thought advisable to stop treatment after 18 grams of sulphapyridine had been taken.

Rashes occurred in only three patients. One developed an urticarial rash, with swelling of the eyelids, on the third day of treatment. The other two developed rashes of the morbilliform type on the fifth and sixth days after the start of treatment respectively.

Major Toxic Effects.—The complications in this group were all of renal origin. Cases of renal intolerance to sulphapyridine are relatively uncommon but the subject is one which has accumulated a considerable literature. No less than 45 articles on this subject were found. The general experience

seems to have been remarkably uniform and corresponds closely with our own. The manifestations of intolerance tend to occur early, usually on or about the second or third day of treatment, and are of sudden onset. They have been described with both intensive and non-intensive dosage but seem to be more common with the former. Hæmaturia is the most constant and in many cases the first symptom of renal damage. Other symptoms are severe lumbar pain, often unilateral at first, which may require morphia for its relief, true renal colic, oliguria and anuria which, in some cases, in spite of treatment goes on to uræmia. Vomiting is usually persistent and severe. In several of our cases there was a marked abdominal distension, a symptom to which there appears to be no reference in the literature. In all cases sheaves of jagged crystals consisting of the acetyl derivative of sulphapyridine were found in the urine. There are records of ten fatalities and post-mortem investigation of some of these showed blockage of the vesical ends of both ureters with concretions formed of this crystalline deposit of acetylated sulphapyridine.

In our series of 502 patients treated intensively there were 5 cases of anuria. Two of these developed uræmia and one died in consequence. A description of both these cases will be given including details of post-mortem examination of the patient who died, which gave evidence of blockage of the vesical ends of both ureters although no actual concretions were found. All these patients had hæmaturia and lumbar pain. Two other cases of hæmaturia and two of severe lumbar pain occurred but anuria did not supervene. It is possibly significant that four cases of anuria, including the two in which uræmia developed, one of hæmaturia and one of lumbar pain, occurred in patients receiving the 8, 6, 4, 2 (tablets) dosage as opposed to the routine 8, 4, 2 dosage which the others were given. The records of over 2,000 patients treated by non-intensive therapy with sulphapyridine during the past year show that there have been two cases of anuria and three of hæmaturia. The two patients who suppressed were receiving three grams of the drug daily when the complication occurred.

The causes of this serious and potentially dangerous complication are not fully understood but there is evidence to suggest (Baines and Wien, 1939) that, whereas many if not all patients excrete up to 50 per cent of their sulphapyridine in the acetylated form, in only few patients does massive precipitation occur in the course of excretion. This may be due to idiosyncrasy but it seems clear that diminution of fluid excretion with consequent increased tubular concentration of sulphapyridine or its acetyl derivative, and perhaps acidity of the urine, increase the likelihood of deposition of crystals. It is interesting to note that renal complications, which developed in six patients receiving the 8, 6, 4, 2 dosage, occurred in rapid succession in a group of patients who were in the same ward at the same time. Previously 90 men had been treated similarly without mishap. Investigation of the circumstances showed that these men objected to, and either evaded or surreptitiously disposed of, the sodium bicarbonate

solution which they were ordered to drink. In the light of experience gained it seems probable that too much faith was placed in the administration of alkali with failure to make certain that sufficient fluid was taken. The bicarbonate solution was unpalatable and these men were convinced that it made them vomit. In neglecting to take the bicarbonate solution they also failed to take sufficient fluids. Afterwards this difficulty was adjusted satisfactorily by giving palatable fluids, such as barley water and lemonade in large quantities, and by giving alkali in small bulk in the form of sodium citrate solution grains xxx to the dose two-hourly.

The following precautionary measures are recommended for patients undergoing intensive treatment in addition to those mentioned in the details of treatment.

(1) The urine should be tested for albumin before the treatment is begun.
(2) Large quantities of fluid should be given by mouth in palatable form.

(3) Some of these men are not used to taking large quantities of fluid and constant supervision is essential to see that they do so.

(4) Alkali should be given in the form of potassium or sodium citrate grains xxx two-hourly. The value of alkali in preventing renal complications has been questioned and is uncertain. It was decided to continue giving it until further evidence was obtained as to its efficacy ; but certainly it is of less importance than the forcing of fluids. The reaction of the urine should be tested each morning, acidity of the urine being an indication for more energetic use of alkalies. In most of our patients the reaction of the morning urine was neutral.

(5) The total quantity of urine passed each day by each patient should be measured. Diminution of the amount in a patient known to be taking and retaining large quantities of fluids would be an indication to stop treatment.

(6) In cases of persistent vomiting fluids should be given by the intravenous drip method if the treatment is to continue.

(7) The following are indications for stopping the drug : (a) Hæmaturia. (b) Severe lumbar pain. (c) Intractable vomiting. (d) Diminished excretion of fluids.

(8) If anuria supervenes operative treatment as outlined below should not be delayed for more than 12 to 24 hours.

The following is a description of the two cases in which uræmia developed; the early stages of their condition resemble closely those found in the other cases of anuria.

Case 1.—Lance-Corporal M., admitted December 9, 1940, with relapsing non-specific urethritis this being the fourth attack since 1938. On examination a thin mucoid urethral discharge showing leucocytes, secondary organisms and epithelial cells was found. He was given intensive treatment (8, 6, 4, 2, 2, 2, 2, 2, 2 tablets), 16 grams in thirty-six hours. After thirty-six hours he developed hæmaturia and pain in the right loin which required morphia for its relief. The urine contained crystals of acetyl sulphapyridine. Tablets were stopped at once,

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but suppression of urine supervened and continued for some days in spite of treatment. During the night of December 15-16 his condition deteriorated rapidly and marked greyish cyanosis, dyspnoea, with sighing respirations, cough and frothy blood-stained discharge from the nose were present. He was unconscious and had epileptiform convulsions. Face and neck were puffy but there was no actual pitting œdema. There were signs of right heart dilation and failure with œdema of the lungs and distended veins in the neck. The blood urea rose from 63 mgm. per 100 c.c. on December 12 to 400 mgm. per 100 c.c. on December 16, the systolic blood-pressure was 180 and the total white cell count rose to 21,200 per c.mm. Marked leucocytosis was a feature of all cases in which renal complications occurred. The following treatment was given :

Continuous oxygen by nasal tube ; lavage of the lower bowel followed by rectal infusion of 30 per cent magnesium sulphate solution ; venesection with withdrawal of 14 oz. of blood followed after two and a half hours by the removal of another pint of blood and intravenous infusion of 4.286 per cent sodium sulphate and 10 per cent glucose in normal saline. That evening (December 16) he began to pass urine and voided 9 pints during the succeeding twelve hours. From this point he made an excellent recovery and on December 21 the blood urea was 35 mgm. per 100 c.c., the patient was normal in appearance and felt well. The urine showed a faint cloud of albumin but there were no pus, blood-cells or casts seen in the centrifuged specimen. On December 28 he was discharged from hospital and returned early in February looking and feeling well, the urine showed no abnormality the blood urea was 34 mgm. per 100 c.c. and the urea concentration test showed normal renal function.

Case 2.—Corporal B., admitted on December 18, 1940, with non-specific urethritis. He was given intensive treatment (8, 6, 4, 2, 2, 2, 2, 2, 2, 2 tablets), 17 grams in forty hours, but after forty hours (December 21) he complained of severe colicky pains in the loins and lower abdomen and the drug was discontinued. Morphia was required to relieve the pain. The patient vomited periodically ; there was no abdominal distension. The total white cell count of the blood was 12,800 per c.mm. rising later to 17,200 (on December 23). During the twenty-four hours that followed several small specimens of urine, heavily stained with blood, and containing crystals of acetyl sulphapyridine, were passed at intervals. On December 22 the blood urea was 73 mgm. per 100 c.c., rising to 94 on the following day and reaching 300 on the day of death. Treatment was given as outlined in the previous case, but without success. He became drowsy with puffy face, sighing respirations, frequent vomiting and fits. He died on December 27.

The pathological findings in this case form the subject of a separate communication by Major N. T. Whitehead, R.A.M.C., to which reference should be made, but the following is a summary of his report and of his suggestions as to the probable sequence of events.

Death in this case was due to the blocking of both ureters by " altered " blood with subsequent anuria and uræmia.

Sulphapyridine crystals were formed in the tubules and were then either forced through the walls of the tubules into the surrounding interstitial tissue or else passed down the tubules into the renal pelvis and thence into the ureters.

Many of those crystals which were side-tracked into the kidney substance damaged adjacent blood capillaries and caused a number of small hæmorrhages. Some of the extravasated blood found its way down the tubules into the ureters.

The crystals which reached the renal pelvis continued their journey down into the bladder but in so doing damaged the walls of the ureters causing subepithelial hæmorrhages. This was particularly so at the ureteral orifices whose lumina were much reduced in consequence.

The narrowed lumina and the sludge-like "altered" blood were held to account for the blockage of the ureters and the fatal consequences.

In the light of after knowledge it is clear that the correct procedure in these cases was to catheterize the ureters and wash out the kidney pelves and ureters in an attempt to clear the obstruction. Unfortunately, we had little knowledge of this complication and its pathology at the time, and this procedure, which might have saved the second patient, was not carried out.

TOXIC EFFECTS IN THE CONTROL GROUP OF 495 CASES TREATED WITH THE ROUTINE FOURTEEN-DAY COURSE OF SULPHAPYRIDINE.

The toxic effects of treatment of this type are now common knowledge, but the details in this group of cases are included for purpose of direct comparison.

Most of these patients suffered to a minor degree from insomnia, anorexia, depression, headache and vague abdominal discomfort. While nausea was the rule, vomiting was unusual and in only three cases was treatment stopped for this reason; in three others who were vomiting, the dose of sulphapyridine had to be reduced. Toxic rashes were the most marked feature occurring in 95 or 19·2 per cent of the cases; these eruptions were of the morbilliform or scarlatiniform type with, rarely, an urticarial element. They were associated with an increase in the severity of the general toxic reactions, frequently with pyrexia and sometimes with a low grade pharyngitis. In 18 of the cases with rashes treatment with sulphapyridine was stopped; in 55 the course was completed with the same doses of sulphanilamide; in the remaining 22 treatment with sulphapyridine was continued to the end of the course. There was one case of hæmaturia and none of agranulocytosis.

COMMENT.

The number of cases is small; the follow up is incomplete and no figures are available for comparison of the end results obtained with the two schemes of dosage. Under these circumstances, no conclusions can be drawn from this investigation; but certain interesting facts emerge. While treating the patients the impression was formed that the intensive method was decidedly superior to other schemes of treatment which had been used. This impression was probably determined by the prompt and clear-cut response to treatment which occurred in the successful cases, and by the fact that the proportion of immediate, group (1), successes was considerably higher in our first 100 cases than in those treated subsequently. In this first 100, 69 were clinically cured after three days of treatment; and our

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first "sulphapyridine-fast infection" was not until the 114th case. That this impression was not altogether justified is shown from the figures which run a close parallel in the intensive and non-intensive groups.

The following advantages may be claimed for the intensive method, at any rate as far as the treatment of gonorrhœa is concerned :

- (1) The period of stay in hospital is shortened.
- (2) The unpleasant complications of treatment which commonly occur on or about the ninth day, namely pyrexia, malaise and toxic eruptions, are eliminated for practical purposes.
- (3) The danger of toxic effects upon the bone marrow is less with a three-day course of treatment than with a full fourteen-day course.
- (4) The incidence of "sulphonamide fastness" and of urethral infiltrations was markedly diminished. In preventing these the addition of urethral irrigations to the routine fourteen-day course would in all probability be equally effective.
- (5) The treatment is more economical in that fewer tablets are required and in-patient treatment is curtailed.

Attention is drawn to the following disadvantages :

- (1) During the short period of treatment many patients vomited a great deal and felt unwell ; on the other hand in many cases the malaise was no worse than is commonly experienced with routine non-intensive dosage. Those patients who had experience of both were questioned and all stated that they preferred the intensive treatment owing to its short duration.
- (2) Renal complications were more common. No doubt the incidence in this series was exceptionally high and it is believed that with the help of present experience it would be possible to avoid the more serious effects of these complications.
- (3) The treatment is not practicable under out-patient conditions.

In view of the fact that we were inexperienced with the method and deliberately prolonged observation and in-patient stay in these cases, it may be that the scales of this investigation are to a certain extent weighted against the intensive method and that, with the help of experience gained, better results could be obtained and the period of treatment shortened in those patients who do not immediately respond to the three-day course.

The proportion of immediate successes in patients with gonorrhœa in both intensive and non-intensive groups is less than that which has been claimed in the large majority of publications on the subject, although the totals shown by the combination of groups (1) and (2) are not far short of the percentages of success which are claimed by most workers who have used sulphapyridine without irrigations. We attribute the difference to the routine tests involving the examination of the morning smear and the all-night urine during the period of observation. In previous work in civil clinics it was not possible to apply these tests as a routine and it is believed that some latent infections escaped notice and further treatment in consequence.

SUMMARY.

(1) 502 patients, including 397 who were suffering from gonorrhœa and 98 who were suffering from non-specific urethritis, were treated with a three-day course of intensive treatment with sulphapyridine, along the lines first suggested by the Aberdeen school.

(2) Of the patients with gonorrhœa 49 per cent required no further treatment and remained in hospital an average period of thirteen days; 15 per cent required a small amount of extra treatment and remained in hospital an average period of twenty-three days, and 36 per cent required considerably more treatment with an average in-patient stay of forty-four days.

(3) Of the patients with non-specific urethritis 28 per cent required only the initial course and the average length of stay in hospital was thirteen days; 7 per cent required slightly more treatment, remaining in hospital an average of twenty-three days, and 65 per cent had considerably more treatment, the in-patient stay amounting to an average of forty-eight days.

(4) A comparison with the same number of cases treated non-intensively with a fourteen-day course of treatment showed that in the two groups there was little difference in the proportion of successes, although in-patient stay was shortened for patients treated successfully with intensive dosage.

(5) The complications of the treatment consisted of minor toxic effects, of which vomiting was the most frequent and troublesome, and of toxic effects on the kidney due to excretion of crystals of the acetyl derivative of sulphapyridine. In consequence there were two cases of hæmaturia, two of severe lumbar pain, and five cases of anuria, in two of which uræmia developed, one terminating fatally. Methods of avoiding or minimizing these complications are discussed.

We wish to thank Colonel H. L. Howell, *O.B.E., M.C.*, Commanding Royal Victoria Hospital, Netley, for permission to publish the result of this investigation, Lieutenant-Colonel T. E. Osmond, *R.A.M.C.*, for helpful advice, Dr. Robert Forgan for his kindness in undertaking the very considerable task of abstracting the literature on renal complications and Major J. S. Sloper, *R.A.M.C.*, Medical Specialist to the Royal Victoria Hospital, for permission to use his clinical notes on the later stages of the two cases described in detail.

REFERENCES.

- ADALJA (1939). *Brit. Med. Journ.*, **1**, 643.
ALLISON and MYERS (1939). *Journ. Amer. Med. Assoc.*, **113**, 18, 1631.
ANTOPOL and ROBINSON (1939). *Proc. Soc. Exp. Bio. & Med.*, **40**, 3, 428.
ARNETT (1940). *Journ. Amer. Med. Assoc.*, **115**, 5, 362.
BACKHOUSE (1939). *Lancet*, **2**, 736.
BACKHOUSE (1940). *Med. J. Austral.*, **2**, 135.
BAINES and WIEN (1939). *Quart. J. Pharm. & Pharmacol.*, **12**, 4.
BANKS (1939). *Lancet*, **2**, 1921.

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- BARFORD (1939). *Ibid.*, 959.
- BOWIE, ANDERSON, DAWSON and MACKAY (1939). *Brit. Med. Journ.*, **1**, 711.
- BROWN, THORNTON and WILSON (1940). *Journ. Amer. Med. Assoc.*, **114**, 1605.
- BUIST, T. B., and SIMON, R. H. (1940). *Journal of the Royal Army Medical Corps*, **74**, 229.
- CARROL, SHEA and PIKE (1940). *Ibid.*, **114**, 5, 411.
- DETWEILER *et al.* (1940). *Archiv. Int. Med.*, **65**, 1144.
- FINLAND, SPRING, LOWELL and BROWN (1939). *Ann. Int. Med.*, **12**, 1816.
- FINLAY (1940). *Med. J. Austral.*, 409.
- FLETCHER (1941). *Brit. Med. Journ.*, **1**, 242.
- FLIPPIN (1939). *Journ. Amer. Med. Assn.*, **113**, 1851.
- FLIPPIN *et al.* (1940). *Ann. Int. Med.*, **13**, ii, 2038.
- GRAHAM *et al.* (1939). *C. M. A. J.*, **40**, 325.
- GROSS, COOPER and LEWIS (1939). *Proc. Soc. Exp. Bio. & Med.*, **40**, 3, 448.
- GROSS, COOPER and SCOTT (1940). *Urolog. and Cutan. Rev.*, **44**, 4.
- HANSSSEN (1939). *Lancet*, **1**, 61.
- HEGLIN (1940). *Schweiz. Med. Woch.*, **70**, 37, 881.
- HODES, GIMBEL and BURNETT (1939). *Journ. Amer. Med. Assoc.*, **113**, 1614.
- JANNEY SMITH (1939). *Journ. Amer. Med. Assoc.*, **113**, 1851.
- KILGOUR (1939). *C. M. A. J.*, **41**, 445.
- KOHLSTAEDT and PAGE (1940). *Ann. Int. Med.*, **14**, 129.
- LONG *et al.* (1940). *Journ. Amer. Med. Assoc.*, **115**, 364.
- LONG and BLISS (1939). "The Clinical and Experimental Use of Sulphanilamide and Sulphapyridine and Allied Compounds."—Special addendum.
- LONG and WOOD (1939). *Ann. Int. Med.*, **13**, 487.
- MCCANN (1938). *Lancet*, **2**, 100.
- MACLEOD (1939). *Journ. Amer. Med. Assoc.*, **113**, 1405.
- NISSEN and ROESGAARD (1939). *Ibid.*, **113**, 1924.
- O'MEARA (1940). *Journ. Roy. Naval Med. Serv.*, **26**, 3, 284.
- PEPPER and HOORACK (1940). *Am. J. Med. Sci.*, **199**, 674.
- PETRO (1940). *Journ. Roy. Naval Med. Serv.*, **26**, 336.
- PLUMMER and EMSWORTH (1939). *Journ. Amer. Med. Assoc.*, **113**, 1847.
- PLUMMER and McLELLAN (1940). *Ibid.*, **114**, 943.
- RAKE (1940). *J. Bact.*, **45**.
- RAVID and CHESNER (1940). *Am. J. Med. Sci.*, **199**, 380.
- ROBERTSON (1938). *Lancet*, **2**, 728.
- ROMCKE and VOIGT (1939). *Ibid.*, **2**, 778.
- SADUSK *et al.* (1940). *Journ. Amer. Med. Assoc.*, **115**, 1968.
- SMITH, EVELYN and NOLAN (1940). *C. M. A. J.*, **42**, 27.
- SNAPPER, LIU, CHUNG, YU and SUN (1939). *Chinese Med. J.*, July 1.
- SOUTHWORTH and COOKE (1939). *Journ. Amer. Med. Assoc.*, **112**, 1820.
- STEWART, ROURKE and ALLEN (1938). *Ibid.*, **110**, 1885.
- TOOMEY (1939). *Ibid.*, **113**, 3, 250.
- TSAO *et al.* (1939). *Ibid.*, **113**, 1316.
- ULLAND (1939). *Nord. Medic.*, **4**, 52.

SOME FIELD AMBULANCE NOTES.

BY LIEUTENANT-COLONEL T. A. BUTCHER, *O.B.E.*,
Royal Army Medical Corps.

DURING the eight months that the Field Ambulance to which the author was attached was in France and Belgium it was sometimes found necessary to use improvisations and unorthodox methods. Some of these were found sufficiently good to be used later as a routine and they are here described in the hope that others may find them of value.

(1) *Portable Shelter*.—This was designed for use in an area inaccessible to motor transport and was used more than once under these conditions. It is possible that it might be found of even greater value by regimental medical officers.

The shelter consisted of a tarpaulin thrown over three iron hoops which were bolted together by two iron rods which formed a ridgeline (figs. 1 to 3).

Additional security was given by two guys at each of the four corners. The ends of the tarpaulin were pegged down. Each end of the shelter was closed by two rot-proof canvas strips overlapping in the centre to allow entrance. The whole was rendered completely light-proof by a canvas "frill" sewn on to the edges of the tarpaulin and overlapping the rotproof canvas curtains at the ends of the shelter.

Dimensions.—Length 14 feet 6 inches. Breadth 9 feet. Height 6 feet. The weight of the iron hoops and rods was 70 pounds, but would be much less if made of tubular metal.

The metal portions, when taken to pieces, occupied very little space in a lorry and could be carried on one stretcher.

The tarpaulin, rolled, was also easily carried on a stretcher.

The shelter was simple to put up or take down. A trained squad was able to erect it in one and a half minutes.

It normally took two stretchers placed longitudinally but could accommodate nine men lying crosswise on groundsheet.

(2) *Portable Drying Room*.—The shelter described above could also be used as a drying room.

Hot air from the end of a field cooker (petrol) was led under the canvas at one end of the shelter. In order to avoid scorching the canvas, the end of the petrol cooker was inserted into a tunnel made out of petrol tins covered with asbestos sheeting and passing under the canvas. The opposite end of the shelter was closed with rot-proof canvas except for 6 inches at the top to allow the escape of hot air. Clothes to be dried were hung on strings running from side to side across the shelter.

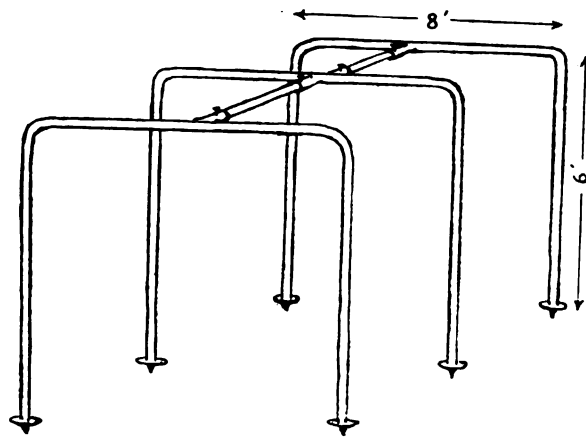


FIG. 1.—Metal frame of shelter.

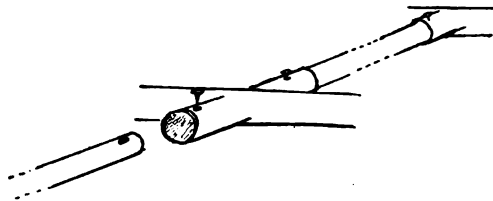


FIG. 2.—Detail of joints of ridge pole.

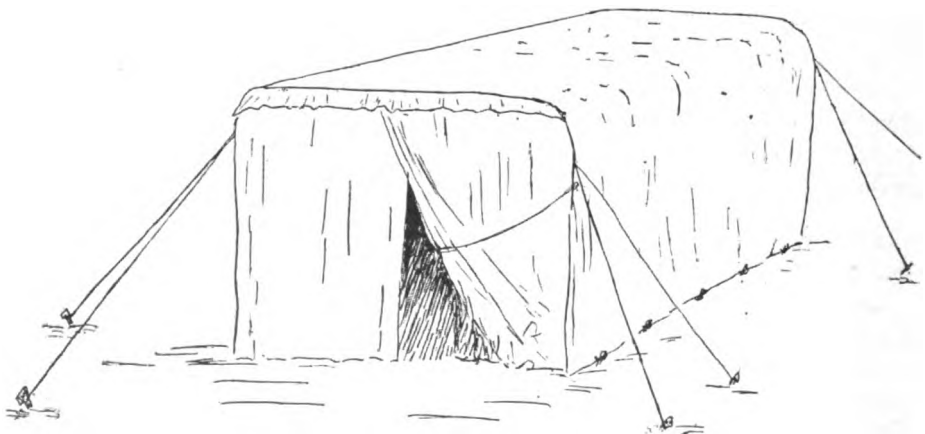


FIG. 3.—Shelter erected.

No extensive trial was made of this method which was devised only a few days before the advance into Belgium.

(3) "*Spat*" Extension for Fractured Femur.—In cases of fractured femur in which it was found necessary to remove the boot a spat was buttoned on to the ankle and extension applied, on the outer side to the buckle of the spat, on the inner side to the strap which was sewn back on itself to form a loop (fig. 4).

This method should be of value in dealing with a case where the boot has become contaminated with mustard gas.

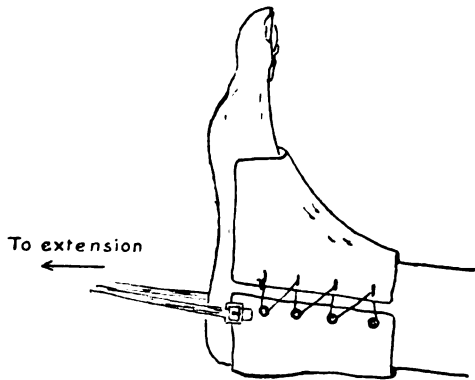


FIG. 4.—"Spat extension" for fractured femur.

(4) *Illuminated Serial Number for Night Convoy Work*.—When travelling in convoy at night, without side or tail lights, and using only the small white light fixed under the tail of the lorry and shining on the differential, it was often very difficult to be certain that one was following the correct convoy. To avoid this, a piece of sheet metal 8 inches square, painted white with the serial number in black, was fixed in metal guides on a wooden block bolted to the bottom of the lorry in such a position that the light shone on it.

The number could be easily read at 40 yards.

The detachable metal sheet was used so that it could be removed and cleaned after a journey.

The ambulance cars were dealt with similarly, except that the black serial number on a white background was painted on the rear cross-member.

(5) *Use of slings*, for hand-carriage of stretcher by four bearers.

When moving over very rough ground, especially at night, the shoulder-carry is liable to be dangerous.

In such cases the hand-carriage over long distances may be made much easier by the use of four stretcher-slings.

Each of the four bearers passes one end of his sling through the opposite loop. The large loop thus formed is passed round the chest and over the shoulder furthest from the stretcher.

The loop on the free end is passed over one stretcher handle and the length of the sling is adjusted so as to take most of the weight on the shoulder (fig. 5).

I am indebted to Captain G. N. Wood, R.A.M.C., for this idea.

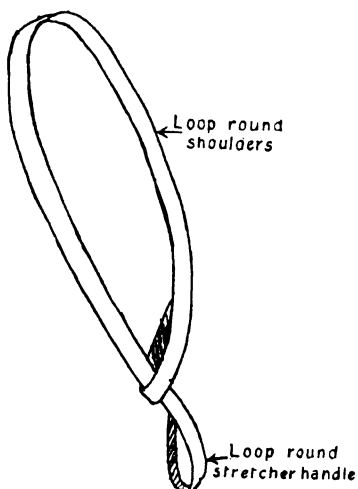


FIG. 5.—Sling adjusted for hand-carriage of stretcher by four bearers.

(6) *Alteration in Loading List for Company Lorries (30 cwt.).*—No. 1 lorry was loaded according to the list appended. This contained everything necessary for the establishment of an advanced aid post ("light section") and so could be sent out at short notice. The remainder of the Company equipment was distributed between the remaining three lorries.

The N.C.O. in charge of each lorry had a list of the contents of his lorry. On this list items that were operationally vital were marked with a red cross.

In the case of a lorry becoming disabled, it was easy for the N.C.O. to pick out and transfer to a rescue lorry the items marked in red and, if necessary, room could be made in the rescue lorry by throwing out the less important of its contents, i.e. those items not marked with a red cross.

LOADING LIST.—"A" COMPANY.

LORRY 1. LOADED AS FOR A.A.P.

F.A.P. No. 2	1
Flags, directing with pole	1
Splints Thomas' complete	2
Bars suspension	2
Stretchers with pillows	18*
Shovels G.S.	1
Sheets ground	15
Medical Comforts Pannier	1

Blankets	40
Brushes sweeping	1†
Containers water 2 gallon	2
Containers kerosene 2 gallon	1
Containers food 1 gallon	1
Cramer's wire pieces	5
Lamps hurricane	1
Tins roasting large	1†
Tins roasting small	2†
Pails galvanized	1†
Axes pick	1
Signs A.A.P.	1
G.S. Pannier	1
Contents :	
Suits pyjamas	10
Hooks reaping	1
Scissors Stretcher Bearers'	6
Slings Stretcher Bearers'	16
Screwdriver	1
Stoves wickless	1
Repair outfits	1
Carbide	lb. 6
Lamps acetylene	1
Lamps oil wall	1†
Pannikins	6
Pincers carpenters'	1
Pliers side-cutting	1
Towels Terry	3
Teapots enamel	1
Warmers stomach with covers	3
Brushes scrubbing	1
Kettles enamel	1
Axes hand	1
Ointment A.G. .. .. .	.. jars 20
Eyeshields boxes of 6	boxes 10
Haversacks surgical .. .. .	.. 2
Haversacks shell dressing .. .. .	.. 3
Shell dressing spare .. .. .	.. 10
Bottles water medical .. .. .	.. 4
Individual detectors .. .. .	.. 100
Detectors gas ground .. .. .	.. Bks. 5
Detectors gas spray .. .. .	.. Bks. 8
Detectors gas spray holders for .. .. .	.. 6
Boots anti-gas .. .. .	.. pr. 8
Trousers A.G. .. .. .	.. pr. 3
Pouches .. .. .	.. 5
Signs warning gas .. .. .	.. 4
Capes A.G. .. .. .	.. 10
Gloves A.G. .. .. .	.. pr. 10
Bleaching powder .. .. .	.. lb. 28
Bags contaminated .. .. .	.. 3

* Includes additional issued and not included on G.1098.

† Indicates items purchased privately.

This lorry is loaded as an A.A.P. with some arrangements to enable the staff to cook.

RANDOM NOTES IN FIELD AMBULANCE TRAINING.

BY LIEUTENANT-COLONEL N. J. GIBSON,

Royal Army Medical Corps.

THE first principle in the training of Field Ambulance personnel as in all other arms of the Service is the inculcation of discipline. It is the basis and the only basis of success. Without it as a foundation technical training is to a large extent a waste of time. But it must be taught, not only enforced. It can be fostered by teaching *esprit de corps* and a high sense of duty, example being the best teacher of all. The kind of discipline which stands best when a testing time comes is that which rests on the mutual respect and affection of the man and his officer but officers have to earn this respect. Among other things they must adopt the principle always of seeing their men are looked after before thinking of themselves and their own comfort. Men will always do their best work when they realize they are being looked after as well as circumstances allow.

Drill is essential—foot, stretcher, saluting and marching. Its importance must be realized and it must not be sacrificed to technical training. Routine P.T. for all ranks should be the rule.

Despite mechanization ability to march is essential. Route marching should be assiduously practised by graduated stages, the standard to be finally attained being 25 miles a day.

During the training period especially a medical officer will realize that to be an efficient R.A.M.C. officer he must have a good knowledge not only of technical subjects but also of many purely military matters.

Officers should have drill and P.T. as for other ranks, so that they may be capable of supervising it apart from its value in producing smartness in themselves. Instruction should be given in orderly room and pay duties and they should learn from the Quartermaster how medical and ordnance stores are indented for, the use of issue and receipt vouchers, how to check stores and draw supplies. Generally they should have a sound knowledge of all R.A.M.C. duties as they apply to other ranks.

They should be able to handle motor cars, lorries, ambulances and motor bicycles and some instruction should be given by the R.A.S.C. officer attached on the mechanism of I.C. engines. Efficient evacuation depends on efficient transport and the R.A.S.C. officer may not always be available to handle breakdowns on service.

Instruction should be given in map reading and compass work. They should know the tactical dispositions and something about the handling of the other arms of the Service within the Division and understand the relation of the Medical Services to each. T.E.W.T.s are the best way of teaching this and also the tactical handling of the Field Ambulance itself.

While knowing something about everything it is considered that each medical officer should have a speciality and know as thoroughly as possible a particular aspect of Field Ambulance work. Officers should be selected according to their suitability for a certain branch of the work—surgery—medicine—bearer work—gas—adjutant.

The training of the R.A.M.C. personnel in technical duties should be done by these specialists, preferably by the officers under whom they will work. A point that occurs here is that nursing orderlies in Military Hospitals are trained by the Nursing Sisters and in their absence these duties will require to be taught by a medical officer. Not all medical officers have a knowledge of sick nursing !

It is considered that the three important things to be taught to nursing orderlies and stretcher bearers are first aid treatment of fractures, the arrest of hæmorrhage and the treatment of surgical shock. They should be thoroughly grounded in these and not over-burdened with detail. A man can be taught to splint efficiently a fractured limb even though he may not know the name of the broken bone. Stretcher bearers particularly must be thoroughly drilled in the putting on of the Thomas' splint till they can do it automatically even in the dark.

Bearer officers should teach the stretcher bearers, thereby getting to know them individually, and they must make a special study of the problems they have to face bearing in mind that much of their work may have to be done in the dark. They should learn how far men can carry loaded stretchers and for how long without relief, how to arrange reliefs, the positioning of bearer posts and car posts and the handling of communications, a point of the very greatest importance.

Thorough training of the stretcher squads is essential and always repays the time spent. They must be highly disciplined, resourceful, have initiative and be encouraged to use it. Their work is arduous and dangerous, they are much on their own, often in the dark, and their sense of duty must be high. N.C.O.s especially must be selected for this latter quality and they must have "guts." A good bearer N.C.O. is beyond price.

Stretcher bearers, in fact all personnel, should know how to handle tools—picks, shovels, etc.—and digging should be practised so that men may learn to throw up shelters quickly for themselves, say at a bearer post, apart from the digging of latrines, etc. Officers should know roughly how long it takes and how many men are required to complete these ordinary tasks so necessary in the Field.

The problem of gas casualties must be thought out and a scheme prepared for their handling. The question arises here whether a special small group of personnel with intensive training might not be more efficient for the purpose than the whole of the Field Ambulance personnel half trained. This group would form the trained personnel for the gas section of the A.D.S. or M.D.S. when required. Two medical officers would be responsible for the training of themselves and this group.

When equipment is issued all ranks must be taught the loading of stores in their appropriate transport and, the best way having been found by experiment, it must be regarded as standard and not departed from. Speed of loading is to be insisted on and this can be attained only by constant practice till the process of loading and unloading is automatic and mechanical as far as possible. "A place for everything," is the rule and the individual panniers should be handled similarly.

It must never be lost sight of that the Field Ambulance is a mobile unit and that it must keep pace with infantry. Unless the twenty-one tons of medical and ordnance stores are handled intelligently and on a cast iron system confusion and delay are inevitable. A word here might be said regarding the gathering of non-essentials, the extras picked up when the unit is stationary for any length of time. This habit must be guarded against. It is fatal to mobility. Transport is provided only according to the weight of War Establishment stores and if extras have to be carried—and the temptation to carry them is great—lorries become overloaded and inevitable breakdown troubles occur.

If canteens are run for personnel, and they ought to be wherever possible, they are, unless carefully watched, a ready source for the collection of rubbish. Canteens must always be under the supervision of an officer who should be responsible for all monies and the payment of bills, keeping of books, etc.

Nothing particular has been said about the knowledge of hygiene and sanitation necessary for all ranks as this appears self-evident but it is considered that the Field Ambulances in this respect should be a model for all the units in the Division to follow.

The contribution to morale generally which can be made by the Medical Services of a Division being efficient, and looking it, cannot be over-estimated.

It is hoped that these few and rather sketchy notes may be of some help to the many young doctors now joining the R.A.M.C. and who may be so fortunate as to find themselves in a Field Ambulance. The doctoring they get to do will come by fits and starts but much more than merely professional capacity will be required of them. In war to be efficient doctors they must be efficient soldiers.

The first quality is assumed, the second has definitely to be learned.



Editorial.

REPORT OF THE GOVERNING BODY OF THE LISTER INSTITUTE, 1941.

THOUGH greatly depleted by the transfer of many members of the Staff to war work the Governing Body of the Lister Institute continues to publish its Report as usual and to make just as many contributions to science as it has done year after year in the past. The main building at Chelsea has suffered, being damaged by the fall of bombs in September, 1940, and again in April, 1941, but the Biochemical and Biophysics laboratories are still there and a large number of members of the Institute Staff have arranged to carry on their work at Oxford, Cambridge and the East Malling Research Station at Maidstone where facilities have been made available.

The research work produced by these members is of a very high order and we think it well to mention some of the more valuable portions of the Governing Body's Report though considerations of space forbid anything but a brief review.

Dr. Muriel Robertson, so well known for her work on the anaerobes of wounds during the last war, has been engaged with Mr. Keppie in a study into the toxicity for mice of strains of *Cl. welchii* from war wounds and air-raid casualties and in a comparison with the clinical features noted in the cases from which the strains had been isolated. "By observing the pH values of the medium at three to four hours, a period coinciding with the peak of fermentation, and again at six to seven hours when toxin production had reached its height, it became evident that strains produced their best toxins at certain pH values. A pH value of 6 to 6.2 at four hours, with a slight movement towards the alkaline side at six to seven hours, was nearly always the successful cycle." The work proves that "while there is little doubt that the more toxic strains are likely to exert a more harmful effect upon the resistance of the patient than the less toxic, it is equally clear that even the less toxic are capable of setting up gas gangrene."

An investigation into the so-called entero- and neuro-toxins of *Bact. dysenteriae* (Shiga) started by Dr. D. W. Henderson and continued by Dr. Steabben has determined the prophylactic values of the corresponding sera against the test infection of mice with the living organisms. The anti-bacterial serum was prepared by immunization with five hours old smooth cultures which appeared to be free from the characteristic Shiga toxin. The antitoxic serum was obtained by immunization with toxic filtrates of the "rough" variant of the same strain and contained 500 units of anti-toxin per c.c. "The antibacterial serum was found to possess high protective value against known infective doses of living bacilli while the anti-toxic serum had no such property." This observation may prove of great utility in the preparation of serum for use in dysentery.

Experiments on antityphoid vaccine have been continued by Dr. Felix who claims that a new type of vaccine with more extensive immunizing properties than the old has now been produced. He considers that the main point is to retain the Vi antibody in its full opsonizing and protecting power. "When a vaccine is stored in the cold, in saline alone, or with the addition of 0.5 per cent phenol or 0.35 per cent tri-cresol, an alcohol-killed vaccine loses almost entirely its capacity of stimulating formation of Vi antibody in the rabbit though O antibody is invariably produced in high titre. It is now found that a vaccine that is not only killed with alcohol but preserved in it still contains the Vi antigen in its effective form after storage in the cold for at least nine months and probably much longer." This will, doubtless, prove to be true. The new vaccine appears to have been found effective in certain tests in the Navy and the Air Force. On the other hand, we know that the vaccine produced by the Royal Army Medical Corps has a high immunizing value and it would seem precipitate to change it for one containing so much alcohol at this time when supplies are short if, as seems likely, the advantages to be gained are relatively slight. The matter, we think, should still remain under consideration. In the meantime, we wish Dr. Felix every success with his vaccine and hope that it may prove as good as he hopes.

Substances that increase tissue permeability receive consideration as also endocrinology, the accessory food factors, the sensitizing action to light of buckwheat and Vitamin C. Under "Endocrinology" there is an interesting report on the nutritive value of yeast. Four samples of *Torula utilis* grown on a molasses medium and roller dried, freeze dried, vacuum dried and spray dried all contained about 60 μ g. riboflavin and 50 μ g. vitamin B₆ per gram dry weight and also equal amounts of filtrate factor complex. "The method of drying had apparently no effect on the B₂ vitamins of the yeast." As an experiment, Dr. Chick has studied the supplementary value of the B vitamins of *Torula utilis* for those in straight run white flour. "The addition of 5 per cent yeast to white flour made it a better source of B vitamins than wholemeal flour, while the addition of 2½ per cent made white flour approximately equal to wholemeal flour as regards B vitamins." Both casein and yeast protein had striking supplementary effects when fed to pigs adequately supplied with all other nutrients but having maize as the sole source of protein. At all levels of protein fed the animals given yeast thrived just as well as those given casein. "As a supplement for the biologically poor proteins of maize, yeast protein is equal to casein, a first-class animal protein." There are so many things that might be mentioned that we tend to forget the space afforded for a notice of this very valuable report. Tomatoes, we see, grown in the open, are markedly more potent as a source of vitamin C than those grown under glass; and we learn that strawberries are as good as citrus fruits in this respect. We lay the report down reluctantly and commend the original to all who may be in need of information on matters intimately connected with our daily lives.

Clinical and other Notes.

THE SILVER NITRATE TREATMENT OF IMPETIGO CONTAGIOSA.

BY CAPTAIN V. J. DOWNIE,
Royal Army Medical Corps.

THE following account of a method of treating impetigo may be of interest in view of the distressing features of this disease and its tendency to spread amongst troops and other communities.

It is a frequent and disappointing feature of the usual treatment of impetigo by unguents that extension of the disease is seldom arrested by the first few applications. Indeed it often seems to be accelerated.

It would appear that the exudate from the sores is the infective agent and that spread occurs via the copious initial flow after removal of the crusts and from seepage over the skin underneath the dressings.

Exclusion of air seems to have a retarding effect on the progress of the disease, which rationalizes the occlusive treatment of impetigo by Elastoplast and may explain the relative avirulence of the disease on the legs as compared with its rapid extension on exposed areas such as the face. It is noticeable that ointments are more effective when well covered with lint than when simply smeared over the lesion.

The principles of the treatment described below are threefold. Firstly, control of exudate and therefore of spread by immediate coagulation of the raw surface which follows removal of the crust. Secondly, exclusion of air by a firm impervious coagulum and, lastly, sterilization of the affected area by powerful caustic action.

The details of the method are as follows: the crusts are gently but *completely* rolled off by prising up a corner with the edge of a pair of fine forceps of the "splinter" type. The raw surface left should be evenly pink in colour: bleeding should be regarded as a result of faulty technique and imperils the success of the method. It should be emphasized that this is not, or should not be, a painful process and that starch poultices or soaking of the scabs are not necessary and only result in contaminating the surrounding skin. As soon as each individual scab is removed the raw area is firmly "blotted" with a small swab wrung out of ether-methylated spirit and gently but thoroughly rubbed with a silver nitrate stick, the application extending just over the margin of the lesion. A greyish-white coagulum forms immediately and subsequently turns black. If the stick is not applied as soon as the raw surface is exposed, exudate oozes on to and infects the surrounding skin. When all the lesions have been treated in this manner all unaffected skin on the face and neck is thoroughly rubbed with

methyated spirit with the object of disinfecting any areas which have been accidentally contaminated during treatment.



Case I.—This is an example of the early type of case in which the arrest of spread is most noticeable and gratifying. The patient is a nursing orderly who contracted the disease whilst treating another patient, and the left hand photograph was taken on the day following application of the silver nitrate. The photograph on the right shows the same patient after six days. There has been no spread and cure is complete. There was an isolated lesion on the scalp which responded in a similar fashion.



Case II.—When first seen this man's scalp was almost entirely covered with impetigo and the hair thickly matted with discharge. The photograph on the right shows the condition on the twenty-seventh day when the cure was practically complete.

No further dressing is required and the patient is seen on the following day and then at intervals of three days to ensure that no fresh lesions have appeared. Occasionally there is very limited extension at the edge of a

coagulated area and these little crusts should be rolled off and the area touched up with the nitrate stick. The coagulum should be closely adherent and almost level with the skin surface or even slightly depressed. The characteristic irritation of the disease is completely relieved within 24 to 48 hours by a successful application.

On the same day that the treatment is started the man's razor is dismantled, washed and sterilized together with his shaving brush in an antiseptic lotion. He is instructed to replace his towel and bolster case (or its equivalent) by clean articles. If the forehead or scalp is affected, the F.S. cap should be steam disinfected. The S.D. cap cannot be treated in this way but the leather hat band can be cleaned with an antiseptic lotion. Washing and shaving near the affected part are not permitted but the beard may be clipped short with scissors.

This treatment should be carried out by a medical officer or by a skilled and conscientious nurse or nursing orderly. Careless or unthorough application of the method neglects the underlying principle of prevention of spread and invalidates the whole treatment.

The advantages of the method are several. It costs practically nothing as compared with the not inconsiderable expense of frequent and often copious dressings for days or weeks. Frequent attendance is not necessary and loss of duty is consequently minimized.

The only disadvantage is that application of the silver nitrate is rather painful if the lesions are at all extensive. However, it is submitted that a single painful dressing is infinitely preferable to the daily and prolonged discomfort of other methods.

It is contra-indicated when ointments have been used previously and in those cases where secondary infection has supervened and removal of the scab reveals a purulent surface. The coagulum is lifted off and softened by the pus and the object of the treatment is defeated.

It is most effective in the early case where only one or two scabs have developed. The rapid cure and complete absence of spread is most gratifying, as the writer can testify from personal experience as a patient.

I am indebted to Corporal Upton, R.A.M.C., for his conscientious treatment of all patients.

AN IMPROVEMENT FOR THE "STRETCHER SPLINT."

BY LIEUTENANT-COLONEL (ACTING COLONEL) J. BRYAN FOTHERINGHAM,
Royal Army Medical Corps.

In a training article published in March 1939 [1] I gave a full description of the use of the "Stretcher Splint" and suggested that "If rough ground has to be traversed, then a broad bandage can be placed round the stretcher and patient at the level of his hips and securely tied."

By using a blanket and a few safety pins one can get much more support for the patient than with any type of broad bandage generally available.

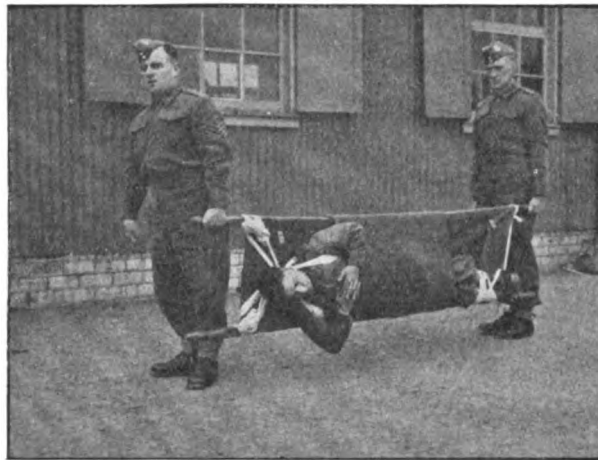
The method is very simple and requires two bearers. Although it may be known to many people, I only discovered it accidentally. The steps are as follows :

(1) A blanket is folded in half lengthways, passed under the stretcher, then over the patient with some 3 inches of blanket edge tucked under the stretcher pole on the injured side, i.e. the same side as the fractured femur.

(2) One bearer holds this edge of the blanket under the stretcher and the other bearer pulls the remainder of the blanket as taut as he possibly can.

(3) The blanket is then carried across the patient for the second time, pulled as taut as possible, and the free edge of the blanket fastened beneath the stretcher to the original fold of blanket by means of six safety pins inserted at regular intervals.

Care should be taken to keep the blanket taut throughout the whole movement. It facilitates the insertion of the safety pins if the side of the stretcher is raised from the ground. As the safety pins are on the opposite side to the injured leg, this raising of one side of the stretcher a few inches off the ground does not tend to cause any movement of the fractured limb.



When moving a patient in the position as shown in the photograph always turn the stretcher towards the injured side. If done the reverse way there is a tendency for the injured limb to move. The upper edge of the folded blanket should be immediately below the patient's costal margin to avoid pressure on the chest.

A combination of the "Stretcher Splint" method, modified if necessary, and this simple use of a blanket with a few safety pins has somewhat similar uses to the "Universal Stretcher Sheet" [2]. Apart from fractured femurs

patients with abdominal or chest wounds, etc., could be first aided for transport through narrow doors, along narrow trenches, through windows, up or down ladders and in many places where it would be impossible to use a stretcher in the orthodox way.

I am indebted to Major J. Howell, R.A.M.C., for the photograph.

REFERENCES.

- [1] FOTHERINGHAM, J. B. *Journal of the Royal Army Medical Corps*, March, 1939.
- [2] R.A.M.C. Training, 1935, para. 449.

A SIMPLE METHOD FOR THE CONVERSION OF 3-TON AND 30-CWT. LORRIES FOR CARRYING STRETCHERS.

BY LIEUTENANT-COLONEL A. L. CROCKFORD, *M.C.*,

Royal Army Medical Corps.

I.—FITTING THE LORRY.

A. Eight lengths of two-inch manilla rope are hung from the iron framework carrying the hood, four each side, to hold the four handles of two stretchers. Each length is spliced with a loop at both ends; one is for the stretcher handle and the other to encircle the bar of the framework and so prevent removal. Total length of each piece with the two loops—21 inches. Total length required per lorry—36 feet.

B. To prevent side sway four lengths of one-inch rope are used, one for each end of the two stretchers. These are spliced with a loop round the two outer longitudinal bars of the hood frame; the free end has a slip noose made with a small wooden toggle. This is passed over and under the inner handle through the inner runner and the noose looped over the outer handle. The noose is then tightened with the toggle. The stretcher is thus firmly laced into the side. Total length required per lorry—30 feet.

II.—LOADING AND UNLOADING.

A. 3-ton lorry—the stretcher is placed on the floor of the lorry, Nos. 1 and 2 getting into the lorry first. Nos. 3 and 4 then follow; the patient is lifted up and the loops slipped on the stretcher handles. The side ropes are then made fast. Unloading is merely a reverse of this procedure.

B. 30-cwt. lorry—here owing to lack of length of the floor of the lorry the driver should fix the tail board horizontal to the ground when the stretcher and squad are inside. This allows Nos. 3 and 4 room to step back when raising the stretcher.

III.—GENERAL POINTS.

This is a simple, cheap, and effective method of carrying two stretchers, leaving the floor free for sitting cases or two more stretchers. The slight degree of freedom of fore and aft movement adds much to the comfort of

the patient. It was devised only for emergency work over short distances. The ropes are all spliced in so they cannot be easily removed ; at the same time they in no way interfere with the ordinary use of the lorry.

THE McCUSKER TRACTION FOOTPIECE AND SUPPORT FOR USE WITH THE THOMAS' LEG SPLINT.

BY COLONEL E. A. McCUSKER, *M.C.*,
A.D.M.S. 1st Canadian Division.

FOREWORD BY COLONEL J. M. WEDDELL, *F.R.C.S., K.H.S.*, Consulting Surgeon.

As described in the following note the traction footpiece and support for use with the Thomas' knee splint in first-aid work and transport of lower limb fractures has been devised by Colonel E. A. McCusker, *M.C.*, *A.D.M.S. 1st Canadian Division.* By eliminating several loose pieces of equipment, simplifying the application, and enabling the patient and splint to be moved as one unit, it is hoped that a very definite improvement will have been made.

The footpiece is being tried out practically and if it turns out to be satisfactory will be adopted for use.

For some time it has been evident to the writer that a simpler method of applying the Thomas' splint must be devised in order to obtain the maximum benefit from its use.

Listed below are difficulties encountered in the ordinary method of application :

(a) Many bandages are required to make a trough in which to support the fractured leg. These require adjusting which is difficult in the dark, and they require so much handling that cleanliness is impossible.

(b) The clove hitch presents difficulties to the inexperienced and interferes with circulation.

(c) The caliper is not satisfactory, nor is the skewer.

(d) A short piece of wood or metal must be carried for a windlass to obtain traction.

(e) The reversible stirrup (Sinclair) must be carried. It is not steady and a bandage must be used to anchor the foot to it.

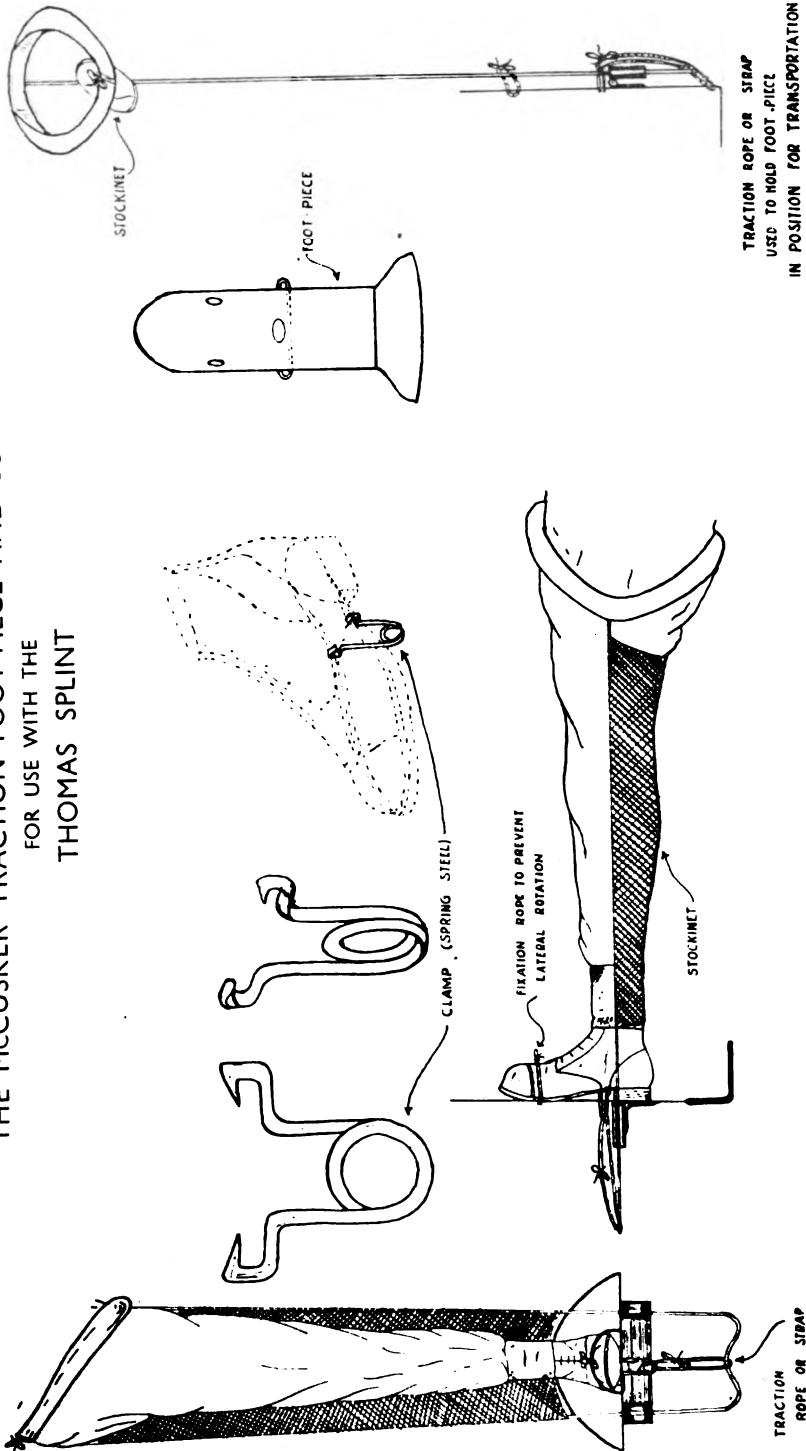
(f) Suspension cannot be obtained until the patient is placed on the stretcher. The suspension bar is then put in place and bandages must be used to suspend and anchor the splint.

(g) The patient cannot be removed from stretcher without removing the suspension bar.

(h) The suspension bar interferes with placing stretcher cases in ambulances.

In addition to the above, this procedure is wasteful of time and material.

THE MCCUSKER TRACTION FOOT-PIECE AND SUPPORT
FOR USE WITH THE
THOMAS SPLINT



TRACTION ROPE OR STRAP
USED TO HOLD FOOT-PIECE
IN POSITION FOR TRANSPORTATION

TO SIMPLIFY THIS TECHNIQUE IT IS SUGGESTED THAT :

(a) A stockinet be slipped over the Thomas' splint to form the supporting trough. This can be sterilized and carried in the waterproof case attached to the splint. It requires little handling and can be put on in the dark. It can be washed several times and decontaminated if exposed to gas. It is inexpensive. (If surgical stockinet is not available the leg of a pair of under pants serves admirably.)

(b) The combined traction footpiece and support which can now be slipped on takes the place of all other equipment in that :

(1) The spring instep clamp which grasps the waist of the shoe just anterior to the heel passes through the oval aperture in the centre of the footplate. The toe is fixed to prevent lateral rotation.

(2) Traction is obtained and maintained by a rope or strap from the spring instep clamp to the notch in the end of the splint.

(3) From the heel of the footplate a bar of light iron extends downward 2 inches then bends at right angles towards the body to rest on the ground, or on the stretcher, and takes the place of the suspension bar.

(4) The patient can be moved readily to and from stretcher.

(5) The toe piece extends high enough to carry weight of blankets.

(6) The footplate is attached to a hinged crossbar which is turned at each end to fold around the parallel bars of the splint, on which it can slide to the desired position but which prevents any lateral or rotary movement. When not in use, the footpiece folds through 90° to lie parallel to the bars of the splint. It is tied in this position and cannot be lost.

Advantages are :

(1) Simplicity, economy, lightness and mobility.

(2) Highly trained personnel are not required for rapid and satisfactory application.

Current Literature.

STOCKS, P. **Morbidity and Death-Rates in the Great Towns.** *Lancet*. 1940, Nov. 2, 550-53, 1 chart.

This report compares the trends of quarterly mortality rates up to the end of June, 1940, from all causes of death and from diphtheria, measles, whooping-cough, and cerebrospinal fever in groups of the great towns classified as evacuation, neutral and reception areas. Notifications of the infectious diseases are similarly examined. In those towns which served as reception areas there was initially a relative rise in total mortality, due probably to the transfer of an undue proportion of infirm persons from the evacuation towns. Subsequently their position improved. During autumn

and winter when schools were closed in evacuation areas and partly closed in neutral areas, the diphtheria notification rates among children in London and the evacuation towns were only half those of a year previously, compared with falls of 17 and 22 per cent in the reception and neutral towns. There was, however, no equivalent reduction in the death-rate. In the June quarter, when schools reopened, the contrast between evacuation and reception towns disappeared. Scarlet fever likewise showed a greater fall in the evacuation towns and this contrast continued in the June quarter when the schools were operating again. Measles and whooping-cough deaths during the March and June quarters in the evacuation towns and in Greater London were very few in comparison with previous years while the neutral towns showed only a moderate fall and the reception towns very little change. For instance in Greater London deaths from measles in the first half of 1940 numbered only 5 compared with 339 in 1938, and 860 in 1936, the last biennial epidemics. The levels and movements of the notification rates for both diseases suggest the removal of the schools as centres of infection during the winter in the evacuation areas and an intensification of infection, perhaps aided by lower levels of general immunity, in the reception towns. New York, however, has also had in 1938-40 the rare experience of two successive winters of low measles prevalence, so the possibility of other explanations must not be overlooked. The cerebrospinal fever notification rate at all ages and the death-rate at ages over 15 during the March quarter of 1940 were higher in the reception towns than elsewhere but this difference was not maintained in the June quarter. Deaths in the first quarter in England and Wales numbered 24 per cent of notifications and varied between 32 per cent in some of the northern counties and 17 per cent in South Wales. The age distribution shows an excessive proportion of elderly women, 15.1 per cent of the deaths of females being at ages 55 or over compared with only 4.7 per cent of males. A. BRADFORD HILL.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

BRAUER, E. Immunized Persons as Diphtheria Carriers. [Correspondence.] *Brit. M. J.* 1940, Nov. 16, 683-4.

The fear that immunized persons may become diphtheria carriers has been expressed again and again and that this fear is not unwarranted the facts recorded by the author bear witness. A child of 5 years was found to be suffering from nasal diphtheria and was removed to hospital. Sharing the house was another family with three children, a boy aged 13 and two girls aged 9 and 5 years. The boy had had diphtheria five years before and the two girls were immunized the following year. All three were swabbed, when the case above-mentioned developed; the boy's swab was reported negative, those of the two girls were positive, although neither presented any indication of disease. In other words, states the author, "the child who had gone through an actual attack of diphtheria was completely immune

against it and proved negative, the other two children, who had been vaccinated against the disease, were immune against contracting diphtheria although they carried the organism in their noses." H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

MACLEAN, I. H. Prophylactic Inoculation against Whooping-Cough.

Proc. Roy. Soc. Med. 1940, v. 33, 425-32 (Sect. Therap. & Pharmacol., 19-26). [19 refs.]

The views on and results of active immunization against whooping-cough were gathered from the author's experiences in a London whooping-cough clinic. Pertussis vaccines should be made only from strains which are in Phase I and which are either newly isolated, or have been maintained in Phase I by growth on Bordet-Gengou medium. Also vaccines are best made from cultures grown on media containing human blood. No chemically altered vaccine is as good as the simple suspension of killed bacteria. The author is not in favour of the very large dose and believes that effective prophylaxis consists in a primary stimulus followed by a secondary stimulus after an appropriate interval. He therefore gives a course of three injections each of 4,000 million organisms, at intervals of three to seven days, following this up with a final injection of the same strength after the lapse of a month. Employing this method in a test group of 513 children with 46 known exposures and 45 suspected exposures not a single case of whooping-cough occurred. In a control group of 154 children with 115 exposures, 89 cases of the disease occurred. The earliest age at which immunization can be attempted successfully is between 6 and 12 months. Children of this age, may safely be given the full scale of dosage and from this period until 7 or 8 years of age they are easily immunized. Also immunization may be undertaken safely during epidemic periods though this is not the best time to choose. Active artificial immunity is generally considered to be life-long but in the face of exaggerated exposure immunity can only be relative. Whooping-cough in a vaccinated child is usually mild or atypical. A. JOE.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

CHICK, HARRIETTE. Nutritive Value of White Flour with Vitamin B₁ Added and of Wholemeal Flour. *Lancet.* 1940, Oct. 26, 511-12, 1 chart.

The Ministry of Food intends to reinforce white flour with vitamin B₁ in order to make its nutritive value more nearly equal to that of wholemeal flour. The lower B₁ content of white flour is, however, only one of its defects as compared with wholemeal. Straight-run white flour (73 per cent extraction) which is the ordinary white flour in use is not only poorer in B₁ but has a lower content of other B vitamins (riboflavin, nicotinic acid, B and filtrate factor) and also of proteins and minerals. The combination of proteins in wholemeal has been shown to have a higher nutritive value

for growth, weight for weight than those of the endosperm. In the present paper, two diets were given to young rats. Diet 1 contained white flour with 10 micrograms pure B_1 added. Diet 2 was the same as diet 1 except that wholemeal flour replaced the white flour and no extra B_1 was added. In the first two weeks, the growth on white flour and B_1 was only half that on wholemeal flour. The groups were then reversed and the slower group, now given wholemeal flour, shot ahead, gaining 24 grammes weekly, whereas the quicker growing group now given white flour fell back and only gained 7 grammes weekly. The digestibility of the white flour was greater, the faeces passed being only one-fifth of those passed on wholemeal, but the utilization of assimilated food was inferior, the amount of food ingested corresponding to 1 gramme gain in body-weight being 3.02 grammes on the white flour diet and 2.47 grammes on the wholemeal. Preliminary trials suggested that perhaps the most serious deficiency might be riboflavin. It is thought unlikely that a shortage of B_2 occurs as it is present in such large quantities all through the grain of cereals. [It seems to the reviewer desirable to point out that in view of the fact that riboflavin is widely distributed in other foods used for human consumption—in milk, meat and vegetables for example—a deficiency of riboflavin in white flour would not necessarily lead to a shortage of this factor in the diet. Moreover, the fortified white flour will contain a valuable addition of calcium.]

DOUGLAS C. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

THOMAS, CARMEN C., and MILLER, EVELYN E. **Rotenone in the Treatment of Scabies. A New, Nonodororous, Nonirritating Form of Treatment. Preliminary Report.** *Amer. J. M. Sci.* 1940, v. 199, 670-74.

Rotenone was originally extracted from derris root (*Derris elliptica*) of which it constitutes 5-9 per cent, and now from *Lonchocarpus nicou* (South American cuberoot) which has a content of about 7 per cent. It is widely used in veterinary medicine for demodectic mange and as a constituent of flea powders. It is colourless, crystalline, insoluble in water but readily soluble in alcohol, ether, acetone, chloroform, benzene, or carbon tetrachloride. Though toxic by mouth, it is not absorbed by the skin. For trial in scabies cases, 1 gramme of rotenone was dissolved in 3 c.c. chloroform, and added, with vigorous shaking, to a mucilage of quince seed and Irish moss to make 1-2 per cent lotion; 0.1 per cent sodium benzoate is added as a preservative. For scabies patients the procedure adopted was the following:

"*First night.*—Bathe with hot water and soap, soaking well and scrubbing all over with a stiff brush. Dry. Rub lotion in well over whole body, except face and scalp. Special attention to hands, armpits, waist, nipples and groins.

"*Next morning*.—Rub lotion in again, without bath. Wear same underwear.

"*Next evening*.—Rub lotion in a third time, without bath.

"*Second morning*.—Rub lotion in a fourth time, without bath.

"*Following evening*.—Bathe thoroughly. Put on fresh underwear, change all bedding, and send to the laundry. Do not apply any more of the medicine, without first returning to the clinic."

Even severely irritated skins gained immediate relief; mild cases were cured in two days, severe ones in a week. The 1 per cent strength usually sufficed, but 2 per cent was better for severe cases; rarely was a second course needed. It is worth trial in other parasitic dermatoses, such as pediculosis, trombidiasis, etc.

H. H. S.

Reprinted from "Bulletin of Hygiene," Vol. 15, No. 8.

Reviews.

SOME ELEMENTARY NOTES ON MILITARY LAW AND PROCEDURE. By Captain P. M. C. Hayman. Cheltenham and London: Cheltenham Press, Ltd. Pp. 70.

The author of this small book has had a great and varied experience of military and civil law. He has produced a book in which the only fault that can be found is the modesty of its title. In a small space it deals with the whole of military law as it is likely to be encountered in the company office. Every reference is given in a good wide margin which also allows space for notes, so that on every point the correct place in the Manual of Military Law or King's Regulations can be rapidly found. Even more remarkable is the fact that in a book of this sort, the author has managed to compress a good deal of quiet humour which makes the book much more entertaining to read on a subject usually considered to be dry. This is a first-class book and it would be invaluable in a company office. C. C.

NEUROSYPHILIS (SYPHILIS OF THE NERVOUS SYSTEM). By C. Worster-Drought, M.A., M.D.Cantab., F.R.C.P.Lond. (Modern Medicine Monographs.) London: John Bale & Staples Limited. 1940. Pp. xiv + 241. Price 10s. 6d.

Dr. Worster-Drought's "*Neurosyphilis*" possesses the great advantage that all that most people want to know about the subject is contained in one small volume.

The whole subject is adequately dealt with and the illustrations are excellent; the section on prognosis should prove particularly helpful. It is encouraging to note that the author believes that it is not the arsenicals

themselves, but their use in inadequate dosage, which predisposes to neurosyphilis. In this he has the support of most clear-thinking syphilologists. Neither tryparsamide nor physical methods of inducing hyperpyrexia receive the attention they deserve whilst there are numerous errors in the text, e.g. *Spirochæte pallida*, *myotonic atrophica*, and the statement that injectio bismuthi B.P. contains 0.02 gramme of the metal in each c.c. Again, 15 mgm. per kilogram of body weight is not an average dose of neoarsphenamine nor is a dose of sulpharsphenamine usually prepared for injection in the same way as neoarsphenamine (i.e. by solution in 6 to 10 c.c. of distilled water).

With the above reservations this little book can be recommended with confidence to all syphilologists.

There is a useful bibliography.

THE NEW M.O. METHOD BEFORE MEDICINES. Privately printed.

A copy of a very useful little book, entitled "The New M.O." has been received from the author, Colonel C. Arthur Webster.

It is primarily intended for medical officers attached to regiments in an A.A. Division but will be of use to all in medical charge of independent units.

Certain passages, however, as, for instance, that on page 10, dealing with Regimental Aid Posts, must be regarded as appropriate to A.A. units alone and would certainly be inapplicable to the R.M.P. of mobile battalions or regiments.

The author is to be congratulated upon the production of a very readable booklet.

J. L. C.

HANDBOOK OF ANÆSTHETICS (Formerly Ross and Fairlie). Fifth Edition.

By R. J. Minnitt, M.D. Liverpool, D.A. R.C.P. and S.Eng., Lecturer in Anæsthetics, University of Liverpool. Edinburgh: E. & S. Livingstone. 1940. Pp. xiv + 364. Crown 8vo. 380 pages. 103 illustrations. Price 12s. 6d. net.

The appearance of a new edition of this Handbook of Anæsthetics—its fifth in twenty-one years—is proof of its popularity. The untimely death of Dr. H. P. Fairlie has compelled the publishers to look for a new author and they have been fortunate to secure the services of Dr. R. J. Minnitt.

In the preface to this edition, Dr. Minnitt states that he has been chary of eliminating anything that has been productive of sound learning and yet which may not have been couched in terms of modern knowledge. This, no doubt, accounts for the fact that some of the methods advocated are not in accordance with modern practice, such as giving chloroform in a semi-sitting position for intranasal operations after packing the nose with adrenalin as described in Chapter 19. The modern method would be to

withhold chloroform and carry out induction with nitrous oxide, oxygen and ether and maintain anæsthesia with an oral endotracheal tube and pharyngeal pack.

Three additional chapters have been written, one on Cyclopropane and Closed Circuit Carbon Dioxide Absorption Anæsthesia, the second on Vinesthene and the third on The Therapeutic Use of Oxygen, Helium and Carbon Dioxide. These three chapters are an important addition to the book.

The chapters on the intravenous methods are somewhat brief and no mention is made of the great value of pentothal sodium in producing short deep anæsthesia with complete muscular relaxation, so useful in manipulative surgery and in reducing dislocations.

As might be expected from the pen of Dr. Minnitt, the chapter on analgesia and anæsthesia in obstetrics is excellent.

The section on endo-tracheal anæsthesia still contains a full account of the almost obsolete method of insufflation which has been replaced by the inhalation method of Magill.

The chapter on local analgesia is good and clear and the same may be said of the section on spinal analgesia though most anæsthetists would doubt the wisdom of spinal injection in the case of acute intestinal obstruction with regurgitant vomiting as advocated on page 340.

The type and illustrations remain excellent. This is a book which should continue to be of great value to students and practitioners and especially useful from a Service point of view. A. S. D.

A SHORT PRACTICE OF SURGERY. Fifth Edition. By Hamilton Bailey, F.R.C.S., and R. J. McNeill Love, M.S., F.R.C.S. London: H. K. Lewis & Co., Ltd. 1941. Pp. viii + 1016; Illus. 880 (116 coloured); Demy 8vo. Price 30s. net.

The above volume is now a well-established student's textbook and the appearance of a Fifth Edition in ten years speaks well for its popularity. The size of a surgical textbook always provides difficulty. Too long a book overwhelms many students; too short a one provides inadequate knowledge. The authors, who should be well able to judge the student's mind, have always concentrated on conciseness and in this edition have added only a few pages. Many of the accounts of disease may appear to be brief and to convey but a poor picture to the mind's eye but, before offering criticism, it is well to consider whether more knowledge could have been conveyed in fewer pages. Criticism will then probably be silenced.

The production of this volume is good and the illustrations excellent. Good sub-titles are invaluable to a student but in places enthusiasm seems to have outrun discretion and tends to result in confusion. This is particularly evident in the chapter dealing with hernia where the sub-title of "Special Forms of Inguinal Hernia" achieves more prominence than the introductory title of "Inguinal Hernia."

Revision has on the whole been well done and the student will certainly never be deterred from reading by feeling that his subject-matter is already out of date. The chapter on acute appendicitis is good but perhaps in a future edition a small paragraph might be added regarding the relative absence of signs and symptoms and the urgency of early operation in childhood. The text (p. 373) also unfortunately suggests that, in acute appendicitis, where the possibility of primary disease of the uterine adnexæ cannot be excluded, a Battle's incision rather than a paramedian incision is desirable.

This textbook's popularity should be maintained by the present edition.

D. S. P. W.

Notices.

SANITARY INSPECTORS' EXAMINATION.

FOR the duration of the war candidates who have served in the Hygiene Sections of the Royal Army Medical Corps will be allowed by the R.S.I. and S.I.E. Joint Board to qualify under regulation 4 by producing a certificate of having worked 125 days in a public health department spread over a period of not less than six months and of having received instruction during that time in all branches of the work and duties of a sanitary inspector for not less than 150 working hours.

"PERCAINE" HANDBOOK.

Under this title, a small handbook has been published by Messrs. Ciba, Ltd., The Laboratories, Horsham, Sussex, the manufacturers of "Percaïne" spinal anæsthetic.

Officers Commanding Military Hospitals in which this anæsthetic is used may, if they wish, obtain a copy of the handbook on application direct to the firm.

JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

Corps News.

AUGUST, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

June 17.—The undermentioned Lt.-Cols. ret. pay (late R.A.M.C.), at their own request, revert to the rank of Maj. whilst empld. during the present emergency.

A. H. Bond (1030). Apr. 3, 1940.

G. A. K. H. Reed (9897). Apr. 3, 1940.

M. White, M.C., M.B. (15600). Apr. 3, 1940.

S. J. A. H. Walshe, D.S.O. (1641). July 29, 1940.

June 20.—Maj. H. G. P. Armitage (15782), having attained the age for retirement, retires June 3, 1941, and remains empld.

Short Service Commission.—The appt. of Lt. D. N. Parry (75587) is antedated to July 1, 1937, under the provs. of Art. 35, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to July 1, 1938.

Lt. D. N. Parry (75587), to be Capt. July 1, 1939, with seniority July 1, 1938. (Substituted for the notifi. in the *Gazette* of July 18, 1939.)

Surgn. Lt.-Col. (temp. Col.) E. A. Strachan, M.B. (15686), having attained the age for retirement, retires Mar. 12, 1941, and remains empld.

Short Service Commission.—Capt. E. J. Crowe (67845), retires, receiving a gratuity. Apr. 23, 1941.

July 1.—Lt.-Col. W. H. Cornelius (6813) retires and remains empld. July 2, 1941.

Maj. (temp. Lt.-Col.) J. H. Bayley, M.C. (8621), to be Lt.-Col. July 2, 1941.

Capt. (Qr.-Mr.) H. M. Prince (56852) to be Maj. (Qr.-Mr.). July 1, 1941.

The undermentioned at their own request revert to the rank stated whilst empld. during the present emergency :

As Majcs. :

Col. W. D. C. Kelly, D.S.O., M.B. (1982), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. E. Bennett (9907), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. G. H. J. Brown, D.S.O., M.B. (9970), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. F. P. Lauder (10183), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. W. Bowater, M.C. (16701) (R.A.M.C. T.A.) (Res. of Off.). June 1, 1941.

July 11.—Lt.-Col. W. H. Cornelius (6813), having attained the age for retirement, retires and remains empld. July 2, 1941. (Substituted for the notifi. in the *Gazette* of July 1, 1941.)

The undermentioned Lt.-Cols., ret. pay (late R.A.M.C.), at their own request, revert to the rank of Maj. whilst empld. during the present emergency. July 29, 1940 :

R. F. O'T. Dickinson, O.B.E., M.B. (26035).

R. K. White, D.S.O. (14732).

Maj. L. G. Gibson, R.A.M.C. (8511), reverts to ret. pay on ceasing to be re-employed on account of ill-health, and resumes the rank of Lt.-Col. July 12, 1941.

July 15.—*Short Service Commission.*—The appt. of Lt. K. P. Brown, M.B. (74435), is ante-dated to Feb. 1, 1937, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Feb. 1, 1938.

Lt. K. P. Brown, M.B. (74435), to be Capt. Feb. 1, 1939, with seniority Feb. 1, 1938. (Substituted for the notifi. in the *Gazette* of Feb. 14, 1939.)

July 15.—The KING has been graciously pleased to approve that the following be Mentioned for distinguished services in the field :

ROYAL ARMY MEDICAL CORPS.

Park, No. 7357758 Pte. W.

TERRITORIAL ARMY.

July 1.—War Subs. Capt. H. E. Anderson (87627) relinquishes his commn. on account of ill-health. July 2, 1941.

July 11.—The KING has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army :

Lieutenant-Colonel G. G. Talbot, M.B., F.R.C.S. (67248).

Major (temporary Lieutenant-Colonel) T. C. McKenzie, M.B. (7299).

Major (acting Lieutenant-Colonel) G. M. Lewis (30263).

Major A. Angus, M.D. (32613).

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

DYSPEPSIA IN THE FORCES.

BY COLONEL H. LETHEBY TIDY.

THE large number of gastric cases in the earlier convoys from the B.E.F. took everyone by surprise and it was quickly realized that a high proportion were definite peptic ulcers. The frequency of dyspeptic trouble amongst those joining or called up for the Services is now a matter of common knowledge. Nevertheless one must not exaggerate the position. Dyspepsia is not the commonest cause for admission to hospital or for invaliding from the Services, and the Army is, as a whole, at the present time extremely healthy.

CLASSIFICATION OF THE TYPES OF DYSPEPSIA.

Dyspepsia, as it is met with in the Army as a whole, can be classified in three principal groups.

(1) *Peptic Ulcer*.—In this group are all cases with positive radiographs. It also includes certain “negative X-ray” cases in which clinical specialists are satisfied that an ulcer has been present, as may occur with cases of gastric ulcer when the barium meal is carried out after a course of treatment.

(2) *Gastritis*.—This group is well recognized, but a strict definition is difficult. The symptoms are persistent or recurrent, but radiographs are negative. The term “functional dyspepsia” would be preferable if there were agreement as to the meaning of the word “functional.” If used for

¹ Reprinted, by permission, from the *Proceedings of the Royal Society of Medicine* (Section of Medicine), 39, 411.

this group it should imply absence of demonstrable disease in the stomach and duodenum and elsewhere in the body but without other implications.

(3) *Transient Dyspepsia*.—This frequently occurs among new recruits before they are acclimatized to Army routine. These men can be dealt with satisfactorily in the unit and consequently this condition should not be met with in hospital.

There is a miscellaneous group including such conditions as reflex dyspepsia due to the appendix, gall-bladder, etc., but the number of these in the Army is small.

Dyspepsia occurring as a manifestation of well marked psychoneurosis is not included.

Malingering is rare. Exaggeration of symptoms is by no means uncommon and is not always the fault of the man. Exaggeration of symptoms tends to increase progressively with each admission to hospital, with each repetition of investigations and over-careful and conscientious inquiry into symptoms and with undue retention in hospital for treatment.

Incidence in Hospitals of Cases of Dyspepsia.

In large hospitals dyspepsia will usually account for 15 per cent to 20 per cent of all medical cases and the proportion may be even higher, but this gives an exaggerated view of the incidence in the Army. The proportion of cases of dyspepsia to total admissions to hospital has remained fairly stationary in recent months.

What Proportion of Cases Admitted to Hospital for Dyspepsia have Proved Ulcers?

The large hospitals get a higher proportion of the cases which medical officers in the units believe to have definite ulcers. Secondly, there is a tendency to transient dyspepsia in the recruits. This group can be properly retained in the unit, but if certain medical officers send these cases to hospital it will reduce the proportion of peptic ulcers. The figures may therefore vary considerably in different hospitals.

TABLE I.—ANALYSIS OF 2,500 ADMISSIONS TO MILITARY HOSPITALS FOR DYSPEPSIA.

	Per cent
Duodenal ulcer	32.5
Gastric ulcer	9.2
Peptic ulcer	8.0
Hæmatemesis and melæna	2.2
	<hr/>
	Per cent
Gastritis (functional dyspepsia)	51.9
Gastro-enteritis and colitis	35.0
Appendicitis	6.8
Cholecystitis	2.3
Carcinoma	0.8
Miscellaneous	0.3
	<hr/>
	2.9
	<hr/>
	100.0

Table I is compiled from 2,500 consecutive cases admitted for dyspepsia to several hospitals in different parts of the country, most of the returns covering a period of twelve months or more. The returns are not all on the same system. Certain hospitals have used such terms as "juxta-pyloric ulcers." These latter have been entered as "peptic ulcers." Duodenitis has been regarded as duodenal ulcer. Peptic ulcers constitute 51·9 per cent. Gastritis, which accounts for 35 per cent, will here include such cases of the group of transient dyspepsia as may reach hospital. There is a small group of miscellaneous conditions. The proportion ascribed to appendicitis and cholecystitis are in reasonable agreement with the figures given by Rivers and Pereira for the Mayo Clinic. The proportion of duodenal to gastric ulcers is about $3\frac{1}{2} : 1$.

Why is the Incidence of Dyspepsia in the Army so High ?

There is another question which should be considered first. Is the incidence of dyspepsia higher in the Army than in civilian life ? Did the dyspepsia originate in the Army or previously ?

Newman and Payne in their study of cases of dyspepsia evacuated from the B.E.F. early in the War found that 92 per cent of ulcers had originated in civilian life and only 8 per cent. subsequent to joining the Service. This result has been criticized on the grounds that the cases, though unselected in this country, had, in fact, been selected in France since only a proportion of the admissions to hospital for dyspepsia were evacuated home. Gibson Graham has taken records of cases admitted to hospital over a period of fourteen months, only a few coming from the B.E.F., and finds that 94 per cent of ulcers originated in civilian life with a previous duration of six to seven years. Further, in the group returned as gastritis there is a history in civilian life in 79 per cent with an average duration of seven years. Thus there is no evidence of any undue fresh development of the severer forms of dyspepsia in the Army. The low peace-time figures for admission to hospital also support this statement. These studies draw attention to the early age at which dyspepsia commences in cases which subsequently prove to have ulcers. It is often well marked in the early twenties.

What is the Incidence of the Severer Dyspepsias in Civilian Life ?

There has been an enormous increase in gastro-duodenal disease in recent decades. Denys Jennings concludes that there are no statistics from which this increase can be accurately measured. Fig. 1 (*Lancet*, 1940, i, 446, fig. 13), which is taken from his article, is constructed from the Registrar-General's Returns, and shows the annual deaths from peptic ulcer in males per million living. It will be seen that the deaths from peptic ulcer have increased several fold since the last war. The same is also true of other countries.

With regard to the group of gastritis, there are no statistics which can give us an indication of its incidence.

The only publication as to gastric conditions among civilians during the present war of which I am aware is that of Melton in February, 1940, which records that the admissions to Lewisham Hospital, both for hæmatemesis and for perforated ulcer, have doubled since the onset of war.

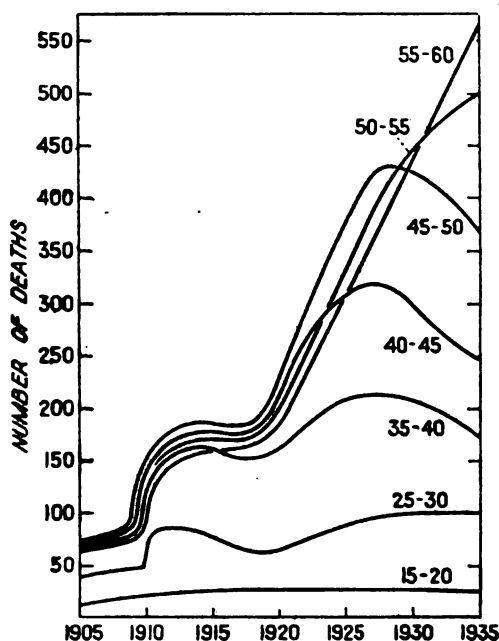


FIG. 1.—Annual deaths from peptic ulcer in males in certain selected five-year age groups. From the statistics of the Registrar-General. The sudden rise in 1911 is due to the inclusion (for the first time) of deaths from duodenal ulcer.—(From "Perforated Peptic Ulcer," by Denys Jennings, *Lancet*, 1940, 1, 446).

Do Chronic Dyspeptic Conditions Relapse more Quickly in the Army than in Civilian Life?

While it is clear that a high proportion of cases of gastritis and an even higher proportion of peptic ulcers originated before the war, the question still arises whether relapses develop more quickly in the Army than would have happened in civilian life. In the Army admissions to hospital are regarded as a relapse and all recurrences will involve such admission. In civilian life, on the other hand, men will often be treated at home for milder recurrences. Some of the men, proved to have peptic ulcers after joining the Service, have had various recurrences in civilian life without entering hospital, and some have never been in a hospital, although they have been treated for dyspepsia over long periods. The frequency of recurrences in civilian life is illustrated by Bashford's study of Post Office employees.

He found that 33 per cent of cases of duodenal ulcer and 50 per cent of cases of gastric ulcer were absent from duty for recurrences for two weeks or more every year. What passes as a slight recurrence in civilian life with a few days' rest on milk diet at home, involves admission to hospital in the Army and counts as a relapse.

Bearing in mind this difference in meaning, I think relapses have developed more quickly in the Army. There is no doubt that a high proportion of cases of peptic ulcer have been admitted to hospital within a few weeks or months of joining the Service. Newman and Payne record that men often think that the attack is the most severe which they have had.

Why do Cases of Organic Dyspepsia Relapse in the Army?

(1) *Army Diet and Army Cooking.*—The Army diet is more liberal, contains more meat and is heavier than the normal diet of the mass of the population. The small proportion of cases admitted to hospital for dyspepsia developing after joining the Service proves that the diet is satisfactory for men who have not previously suffered from such condition.

Diet and cooking may be factors in the rapidity with which dyspeptics relapse in the Army, but they are not the essential cause. It is the Army routine which is incompatible with the continuous maintenance of efficient health in those who are already the subjects of peptic ulcer and certain grades of gastritis.

A bus-driver, the subject of peptic ulcer, once described his routine in civilian life. His trip took eighty minutes, and between each trip he had milk or light food and frequently took Maclean's powder. His régime thus was not far different from Sippey's diet. With this routine he managed to carry on successfully with occasional sick absences for a few days or a week or so. In the Army he was admitted to hospital after a few weeks.

The unsuitability of men with peptic ulcer for the Services is no new discovery for the Army authorities. A man in peace-time may live in married quarters and take money instead of part of his ration, but it was found many years ago that if a man has a peptic ulcer he could not stand Army life and it has long been a regulation that he should be invalided out of the Service.

(2) *Influence of Psychological Factors.*—It may happen that, in the case of a man reporting sick with complaint of dyspepsia, the medical officer, on a general survey, may decide that he is primarily a psychoneurotic and refer him to a psychiatric specialist. If he agrees the man may be discharged forthwith from the Service or sent into hospital under a specialist. I have seen a certain number of these cases thus admitted to hospitals, and, as a general physician, I would agree that they are essentially psychoneurotic and not primarily dyspeptic.

This, however, is not the whole problem. The question arises as to the frequency of psychological factors in the development or recurrence of

what may be called organic dyspepsia, that is peptic ulcer and some grade of chronic gastritis.

Newman and Payne decided that there was practically no evidence of psychological factors. Certain other investigators are in agreement, but others would classify all X-ray negative cases as neurotic.

The possibility of psychological factors is obvious, including such disturbances as worry about business and separations from home and family. But one of the greatest anxieties of civilian life, insecurity of occupation, is removed, for a man cannot lose his job, is fed and clothed and paid regularly. Attention may be directed to the acknowledged rapidity with which ulcer patients lose their symptoms under a dietary régime in hospital without

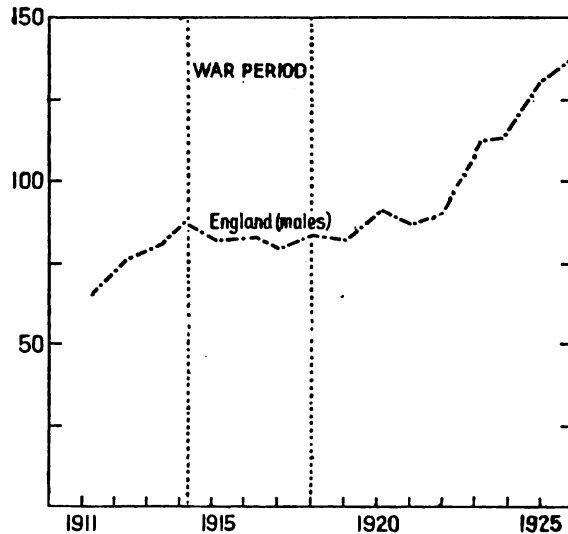


FIG. 2.—Number of male deaths in England from all peptic ulcers per million of the population (Registrar-General).—(Adapted from "Perforated Peptic Ulcer," by Denys Jennings, *Lancet*, 1940, i, 444).

any attention to psychological aspects and in contrast to the more obstinate symptoms of chronic gastritis.

The psychological disturbances present in this war existed also in the last war, with the exception of bombing which has only become important in the last few months, and hence it is not irrelevant to inquire what effect the last war had on the incidence of peptic ulcer. Fig. 2 (*Lancet*, 1940, i, 444, fig. 6), which is also taken from Denys Jennings' article, shows the annual deaths from peptic ulcer in males per million living recorded in the Registrar-General's Returns. Fig. 1 shows that the rise had begun before 1911 and continued until 1914. Fig. 2 shows that, during the war period, the incidence was stationary or even fell slightly. After the war the rise immediately began again. Thus the rise in the annual deaths per million living was checked during the war and commenced again at its conclusion.

This is in agreement with the observations in France during the last war that peptic ulcer and all dyspeptic disturbances were noticeably rare. In the "Medical History of the War," gastric disturbances are scarcely referred to and duodenal ulcer does not appear as a separate heading in the statistics. The last war affords no evidence that the relapses in cases of peptic ulcer and chronic gastritis can be attributed to concomitant psychological disturbances. It should be realized that there is no evidence that the present war has been accompanied by any increase in the incidence of peptic ulcer or other severe gastric disturbances. What the present war has so far revealed is the unsuspected frequency of peptic ulcer and gastritis in the civilian population before the War commenced and the not surprising fact that organic dyspepsia is incompatible with Army life.

GASTRITIS.

The group formed 35 per cent of the 2,500 cases mentioned above, but as a representation of its frequency the figures are open to the fallacy that a smaller proportion of this group than of peptic ulcer find their way into hospital.

Graham and Kerr find that there is a history of similar symptoms previous to joining the Service in 80 per cent of this group with an average duration of seven years. This is evidence of the prevalence in civilian life and it is possible that this condition has increased *pari passu* with peptic ulcer in recent years but, except from the limited aspect of gastroscopy, little attention has been paid to it.

The symptoms in many cases so closely resemble those of the ulcer syndrome that they may almost be described as near-ulcers. A few are undoubtedly ulcers, negative to X-rays, but this is not the full explanation. It is the common experience of civilian practice that these cases rarely develop demonstrable ulcers or the recognized complications of that condition.

Some of these cases approach the border line of definite psychoneurosis and there appears to be a greater aura of psychological factor in this group than in frank ulcers. But it is not the primary factor throughout, nor do I believe that psychiatric treatment will rid men of their symptoms. These men are not malingerers, but they rapidly become exaggerators as the result of over-investigation and treatment and the group, as a whole, requires some degree of firmness which, in fact, they receive in civilian life and to which they have to conform unless they are prepared to lose their occupation.

In peace time these cases may be sent by their doctor to a hospital where they are admitted and "investigated fully." If "all investigations are negative" they are then disposed of in a third common phrase: "Sent back to his doctor." The man may continue to visit his doctor or an out-patient department, but it is important to note that in most instances he succeeds in continuing at his work.

Gastroscopy takes the investigation a step further, but at present it has provided no solution and only adds a diagnosis in a small number of cases. Gastroscopy justifies itself in many directions. Thus it can occasionally establish the presence of a carcinoma or of an ulcer not revealed by X-rays, and it can recognize that a gastric ulcer is not healed although all symptoms have passed. But when other changes in the mucous membrane are in question, gastroscopy has not yet sufficiently established the limits of normal or the interpretation of the abnormal.

In the Army a short course of treatment for men in this group is rarely successful in ridding them of their complaints, for symptoms are more obstinate and more continuous in this group than in frank peptic ulcer. As soon as possible after the investigations are complete and after a short period of treatment, they should be sent back to their units without waiting for complete relief from dyspepsia. They may be given such advice and assistance, medical and psychological if desired, as is compatible with Army routine. It is then the function of the medical officer of the unit to keep them on duty and a number of these men do, in fact, make useful soldiers in spite of their disabilities. If the attempt to keep them on duty fails, but not until there has been a proper trial, they should be sent again to hospital and, in many cases, they should then be invalided out of the Service. Medical officers of units often fear that an ulcer has been overlooked, and some complication may occur for which they will be blamed, but in fact such catastrophes are extremely rare. A more excusable difficulty rises from the tendency to vomiting, which also occurs with peptic ulcers. A possible explanation is that the men get unusually hungry after a morning in the open air and eat too hearty a meal. In my experience, it is rare for a second investigation to be positive when the first has been negative. I would also call attention to the value of careful tests for occult blood.

TRANSIENT DYSPEPSIA.

Judged from the figures from attendances at Medical Inspection Rooms of Training Centres, transient dyspepsia is more frequent than all the other groups together. It is not so common in hospital wards and, indeed, ought to be unknown there. We are here getting away from hospitals and looking at dyspepsia as seen in the units.

A healthy man when he joins the Army is placed in a new environment and often develops symptoms of dyspepsia about the second fortnight, for which he reports sick. A parallel is the dyspepsia which often affects healthy persons when taking a holiday in another country. An experienced medical officer recognizes the condition, reassures the man and explains it to him and gives him a bottle of medicine. This last is essential as otherwise he would be branded as a malingerer which he is not and knows that he is not. He may report sick twice in the following fortnight, once in the next and then no more is heard of him. He has become acclimatized. But

a medical officer not so experienced, or lacking self-confidence, may send the man to hospital for a specialist opinion. This is the first mistake. The medical specialist should return him at once to his unit, but he may make the further mistake of admitting him to hospital for investigation, which proves to be negative. In this group, unlike chronic gastritis, the symptoms, respond readily to hospital treatment and the man is sent back "cured" to the Training Centre. But although the symptoms have been removed the man has not been acclimatized and the cycle starts over again and he is then admitted to hospital a second time. It is almost true to say that a recruit who has twice been admitted to hospital within a short time for the same complaint will not subsequently get rid of the symptoms. His chance of making a useful soldier has been taken away and, further, he can claim that in the Army he developed chronic dyspepsia from which he had never suffered previously.

TABLE II.—GASTRIC CASES SEEN BY A MEDICAL SPECIALIST IN ONE WEEK.

(1)	Peptic ulcers	...	...	...	...	...	11
(2)	Admitted. Indefinite or severe cases	...	...	...	...	...	2
(3)	Returned to units : M & D	...	...	...	...	...	7
(4)	Recommended for discharge for conditions other than gastric	...	...	...	...	...	2
Total							22

Table II is an analysis of cases of dyspepsia sent to the medical specialist of a military hospital during one week from units and records his opinion and disposal of them. Seven men were sent back to duty, most of these being transient dyspepsia which should have been kept in the unit. The return of these cases and a note from the medical specialist instructs the medical officer that he should have dealt with them himself. Two cases only were admitted. The illustration here given is a satisfactory record. If the medical work is weak the figures will be disproportionately higher in Nos. 2 and 3. When dyspepsia in the Army is discussed it is often solely on the basis of cases seen in hospital wards which only gives a partial picture. The medical officer of a training centre, especially an experienced general practitioner, sees the complete picture more correctly.

CONCLUSION.

Men with peptic ulcer should be invalided out of the Service without delay. The diagnosis may be justifiable on clinical grounds although radiographs are normal.

Efforts should be made to keep on duty men with chronic gastritis. If admitted to hospital they should be returned to the unit after investigations are concluded without waiting for complete relief of symptoms. Many of them make useful soldiers with no greater discomfort than affects them in civilian occupations. But if the attempt fails and a man has been repeatedly admitted to hospital, he should be invalided out of the Army. Placing in a lower category is rarely effectual.

It is important that the symptoms in transient dyspepsia should not be converted into a permanent disability by injudicious handling.

A high proportion of the cases both of peptic ulcer and gastritis suffered from similar symptoms for a period of years before joining the Service and there is no evidence that the number of new cases developing in the Army is in excess of the number which would occur among an equal population in civilian life in the same time.

The incidence of peptic ulcer and gastritis in the civilian population is greater than has been realized and has increased rapidly in recent years. The establishment of a special hospital for the study of gastro-duodenal diseases is long overdue.

My thanks are due to medical specialists and others in many hospitals and especially to Lieutenant-Colonel Gibson Graham and Captain Kerr whose article I quoted from before publication with their permission, and to Major J. G. Scadding.

REFERENCES

- JENNINGS, DENYS (1940), *Lancet*, **i**, 444.
GRAHAM, J. GIBSON, and KERR, J. D. OLAF (1941), *Brit. M. J.*, **i**, 473.
PAYNE, R. T., and NEWMAN, C. (1940), *ibid.*, **ii**, 819.
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CURRENT INVESTIGATIONS OF THE INFLUENZA PROBLEM.¹

BY MAJOR C. H. STUART-HARRIS, M.D., M.R.C.P.,

Royal Army Medical Corps.

THE problem of influenza is one which concerns us all intimately, not only because influenza is a major cause of sickness both in the Army and among civilians, but because it is responsible for personal illnesses familiar to us all. Probably some of us may have imagined that once the cause of influenza was demonstrated in the form of a virus which could be studied in the laboratory, it would be easy to produce a specific prophylactic capable of solving the problem of control of the disease. Yet in 1941, eight years after the discovery of influenza virus, we are still without proof of the effectiveness of any weapon that will enable us either to prevent infection or to attack it when infection has already occurred. Many factors are responsible for this apparent lack of progress and it is not my purpose today to detail these. Instead, I want to describe some investigations which we have been able to carry out during recent months upon cases of influenza admitted to a military hospital. Such ætiological investigations of outbreaks of influenza, which follow upon those of former years (Stuart-Harris *et al.*, 1938, 1940), are vitally necessary to our attack upon the influenza problem because of the fact that more than one influenza virus is now known to exist. The failure of Francis (1937*a*) to demonstrate influenza virus in an epidemic of influenza in California in 1936 was followed by our own perplexing experiences at Hampstead in 1939, when only 30 per cent. of cases of clinical influenza that year yielded serological evidence of infection by the then known influenza virus. Last year Francis (1940), succeeded in demonstrating a new type of influenza virus in cases of influenza in the United States, and this has been named influenza virus B in contrast to the previously known virus A (Horsfall *et al.*, 1940), from which it differs both serologically and in its pathogenicity for animals. The knowledge that at least two influenza viruses exist obviously makes the production and evaluation of any specific prophylactic much more difficult. Moreover, it is clear that the part played by these two viruses in the production of human epidemics must be elucidated and this can only be done by a careful study of every outbreak of respiratory infection which occurs.

EPIDEMIOLOGICAL AND CLINICAL STUDIES.

The investigations which I wish to describe have consisted of a combined clinical and pathological study of the cases of acute respiratory infection

¹ Read at a joint meeting of the Salisbury Division of the British Medical Association and the Clinical Society of a Military Hospital, July, 1941.

admitted to a military hospital during the winter 1940-41. Chart I shows the total figures for weekly admissions to, and detentions in, the hospital of cases of acute respiratory infection. The continuous line represents the minor upper respiratory infections such as colds, pharyngitis, tonsillitis, quinsy and simple influenza and the broken line includes cases of bronchitis and pneumonia as well. In November and December, the total weekly number of cases varied from about twenty to thirty-five and represented a low rate of sickness considering the number of troops at risk in the area. The majority of the upper respiratory tract infections comprised cases of exudative tonsillitis, pharyngitis, Vincent's Angina or quinsy. In January an abrupt change in clinical type occurred and the numbers, both of cases

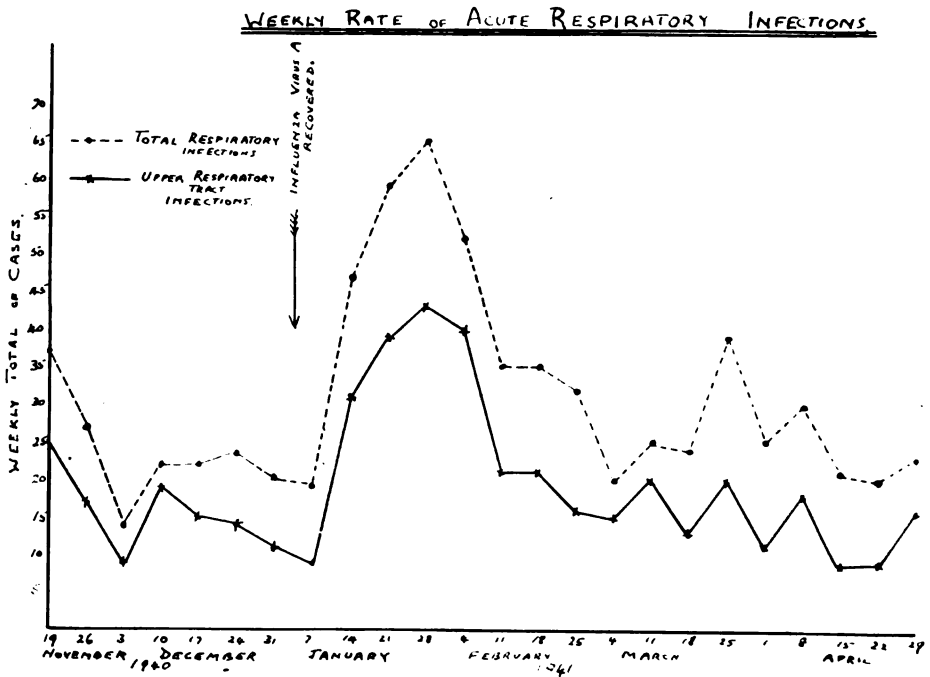


CHART I.

of upper and lower respiratory tract infection, rose to a peak and then subsided. Even at the peak only sixty-five cases were admitted in one week and it cannot be claimed that the incidence represented an outbreak of any magnitude. Nevertheless, the form of the curve was quite typical of that of epidemic influenza and the clinical findings in January and February supported the view that the then prevalent disease was influenza. The average clinical type of case seen during these two months was a short febrile illness of abrupt onset, which lasted two to four days, with complaints of general illness, headache, shivering, muscular pains and cough. At the

onset of the illness, the facies was often characteristic with flushing or suffusion of the face, slight cyanosis of the lips and glistening, suffused conjunctivæ. The nose was usually slightly involved with either discharge or obstruction and the fauces were injected but not usually sore. The cough, which was almost invariable, was short and dry but rarely paroxysmal or painful, and was accompanied in a number of simple cases by the presence of scattered râles or rhonchi in the chest at an early stage of the disease. This clinical picture, which may be best illustrated by the following two cases, was clear-cut and similar in every respect to that seen in 1937 during the widespread influenza epidemic of that year (1938 M.R.C. Report). Influenza virus A infection was proved in each of the following two cases in ways which will be detailed later.

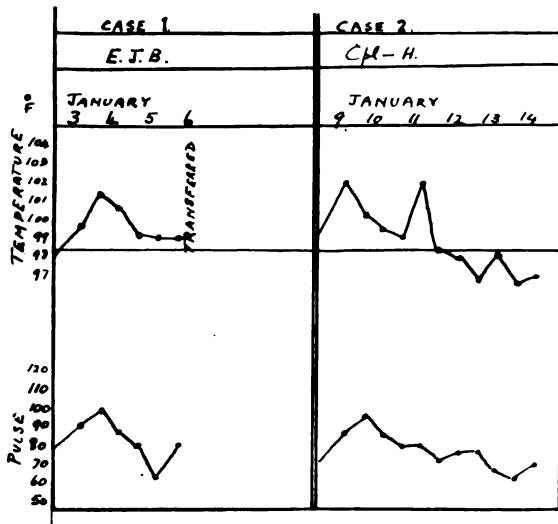


CHART II.

Case 1.—Private E. J. B., aged 26. Was quite well until the evening of January 2, when he slept poorly. In the morning he shivered and developed a frontal headache and aching of the back and legs. He vomited three times, but had no other abdominal symptoms. The nose was stuffy and there was a slight cough. There was no soreness of the throat. Upon admission the temperature was 99.6° F., rising to 101.2° F. with a pulse of 96. The facies was not particularly characteristic, but the conjunctivæ were abnormally glistening. The pharynx was injected with a red, dry, rather granular posterior pharyngeal wall. There were no abnormal signs in the chest. Symptoms had subsided during the next twenty-four hours, but on the third day the temperature was still 99° when the patient was transferred to another hospital. Temperature chart may be seen by reference to Chart II.

Case 2.—Corporal H., aged 23. Was quite well until the evening of January 8, when he slept restlessly and developed a cough. On the 9th he shivered and

complained of a headache and pain in the back. There was very slight sore throat and a cough accompanied by slight expectoration. On admission this day the temperature was 102° F. and the pulse 88; the facies was characteristic with flushing of the face, drooping eyelids and suffused conjunctivæ. The nose was normal, the tongue coated and the fauces were mildly injected. There were no abnormal signs in the chest. The next day brought a remission of the fever accompanied by a general improvement in symptoms but on the third day the temperature rose sharply to 102° F., and the patient was again miserable with shivering and headache. Cough also was worse and occasional râles were heard over the left base. On the fourth day the temperature fell to normal and convalescence set in rapidly but the patient was still pale and washed-out on the day of discharge five days later. The temperature chart of this patient showed the so-called diphasic curve.

Such cases as these comprised the majority of uncomplicated febrile cases of upper respiratory infection admitted to the hospital in January and February. It was noteworthy that the ordinary type of case of acute follicular tonsillitis was almost entirely absent during these months. In addition to such "typical" cases there were, however, milder cases of one-day fever or even normal temperature accompanied by a coryza, a sore throat or a cough, yet usually with general symptoms such as shivering, headache or muscular aching. Severer infections comprised the patients with signs of bronchitis or bronchiolitis in which the general symptomatology was identical with that of uncomplicated influenza but the illness was dominated by the chest condition. A number of cases of pneumonia were admitted in January and February, but were not studied clinically by me. After the first two or three weeks of January the clear-cut picture of the acute type of case became slightly obscured. The disease appeared to become slightly more catarrhal with more definite coryza and sore throat, or occasionally laryngitis or tracheitis, and the onset of the illness was less acute. There was, however, no sharp distinction between these cases and the earlier ones and it was not until March that a clear change in the clinical type occurred with reappearance of exudative tonsillitis and quinsy as seen in November. Complications were seldom seen in the cases of influenza and, although one or two cases of post-influenzal pneumonia or pleurisy were admitted, relapses were uncommon. The average duration of fever and the severity of illness appeared to be comparable with that seen in 1937; yet the disease had a remarkably low infectivity and, although most units in the area were affected, the total incidence of the infection was low.

Pathological Investigations.—Pathological investigations have been carried out upon cases of respiratory disease during the winter in close collaboration with Dr. C. H. Andrewes and his colleagues at the National Institute for Medical Research, Hampstead. The investigations have consisted of attempts to recover influenza virus from throat washings and examination of sera from individual patients for neutralizing antibodies to laboratory strains of influenza viruses.

RECOVERY OF INFLUENZA VIRUS A.

My own attempts to demonstrate influenza virus in the throats of patients with respiratory disease consisted in inoculations of living chick embryos with filtrates of human garglings. The recovery of influenza virus in the laboratory from human material has been much hampered in the past by the fact that the common laboratory animals are resistant to infection by influenza virus in the state in which it is present in human secretions. Although others have reported successful recovery of virus by direct inoculations of tissue cultures or of mice with human material (Francis and Magill 1937, *c, d*), ferret inoculation has so far been the only method by which we have succeeded in recovering virus in this country. The limitations of ferret work imposed by the infectious nature of influenza in the ferret, and the susceptibility of this animal to dog distemper, made it impossible for me to use ferrets in the absence of facilities for segregation of the individual animals.

Last year, Burnet in Australia showed that if influenza virus was introduced directly into the amniotic cavity of the developing chick embryo, characteristic lung lesions developed and a cellular exudate appeared in the primitive bronchioles and the trachea (Burnet 1940, *a* and *b*). Burnet mentioned without details that he had successfully isolated virus direct from human garglings by this method (Burnet, 1940, *b*). Burnet's technique was therefore employed by me, first of all with the laboratory strain of virus A (P.R.8) and, from December onwards, with human materials. Garglings in saline and broth were clarified through asbestos and paper-pulp filters, filtered through Gradocol collodion membranes (Elford 1931) kindly given to me by Dr. W. J. Elford of the National Institute for Medical Research, and were inoculated directly into the amniotic cavity of 12-day old chick embryos. The embryos were incubated at 35-37° C. and were examined on the third or fourth day, passage to other embryos being carried out with an emulsion of the lungs and heart of the embryo in fluid pipetted from the allantoic and amniotic cavities. Histological preparations of the fluid present in the trachea of the embryo and of the lungs were also made.

By this technique, four garglings were tested from cases of upper respiratory infection in December, four in January, one in February soon after collection and three after storage in the refrigerator for several weeks. Nothing resulted from all these tests except with two garglings from the January collection (Chart III). One of these garglings (Tay . . .) at once produced the characteristic histology of influenza virus A infection of the chick embryo as described by Burnet and transmission to other embryos was readily successful. The second gargling (Ber . . ., from patient Case 1) produced no lesions in the chick embryo of the first or second generation but characteristic lesions were found in the third generation and thereafter transmission was readily successful. It was also possible to adapt both these strains of virus to mice as shown in the chart and in one case this

was done using material from the first generation of chicks for initial mouse inoculation. As a precaution against laboratory cross-contamination, work with laboratory strains of influenza virus had been discontinued in January and it is only necessary to add that the two strains, Tay . . . and Ber . . ., exhibited the usual characteristics of freshly isolated human strains in their low virulence for mice.

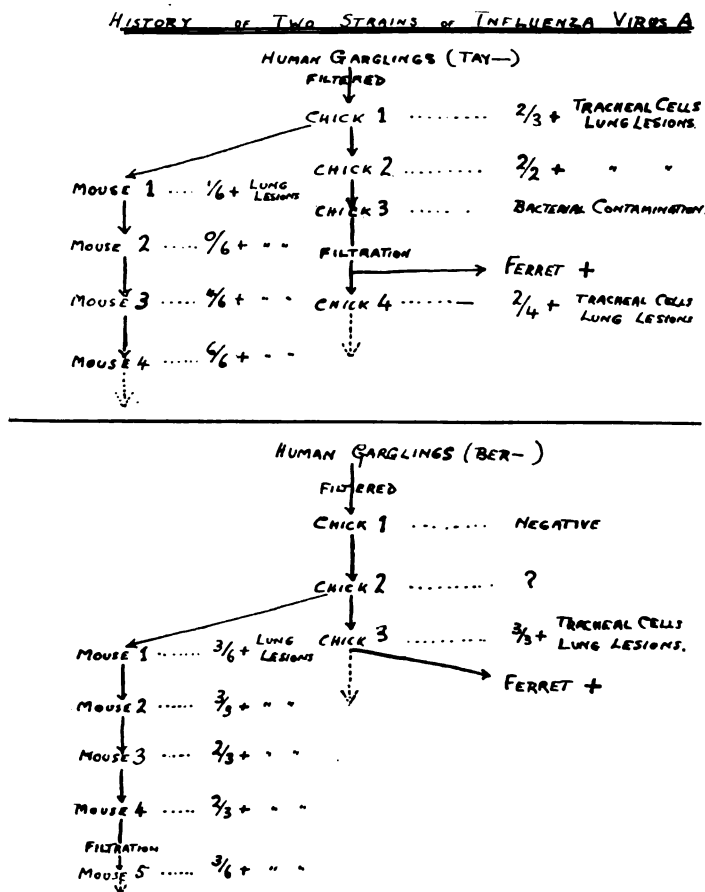


CHART III.

The numbers 1, 2, 3, etc., applied to chick and mouse refer to generation of passage, not to individual animals. Results in the latter are expressed as positive in x out of y animals.

During the progress of these investigations, Dr. Andrewes was testing garglings from London and elsewhere on ferrets and his colleague, Miss Dora Lush, was testing filtrates on chick embryos by amniotic inoculations. Miss Lush was unable to establish any strains of virus from human material

directly in chicks, but Dr. Andrewes obtained typical ferret responses with a number of garglings and with my two chick strains (Andrewes *et al.*, 1941). It was shown by Dr. Andrewes that the two chick strains isolated by me and also the ferret strains isolated by him this year were related serologically to the P.R.8 laboratory strain of virus and therefore belong to the group of influenza A. The proportion of garglings positive in the ferret this year was low, however, and only one of three garglings sent from here to London gave a reaction in the ferret. Thus, both with the chick technique and with the ferret, isolation of virus was obtained but was difficult. Indeed, had it not been for the success with the Tay . . . and Ber . . . garglings, we should probably have concluded that influenza virus will rarely infect the chick embryo in the state in which it is present in human secretions. Yet the garglings collected in January and February which were negative in the chick and two which were negative in the ferret, came from cases of influenza as severe and typical clinically as those of Tay . . . and Ber . . . It was therefore imperative to determine whether the cases of clinical influenza which failed to yield virus by direct test were cases of virus A or of some other infection. To do this we were able to use the method of investigating sera for neutralizing antibodies to the laboratory strains of the influenza viruses.

EXAMINATION OF SERA FOR NEUTRALIZING ANTIBODIES.

The examination of sera for neutralizing antibodies to influenza virus is an accepted method for the diagnosis of influenza virus infection (Francis *et al.*, 1937 *b*, M.R.C. Report 1938). Serum is collected from a patient during the acute stage of the illness and six to fourteen days later when convalescence has set in. Both sera are examined by mixing dilutions of serum with virus filtrate from a mouse-adapted strain of influenza virus and inoculating the mixture intranasally into groups of mice. In influenza virus infection the convalescent serum has a greater neutralizing capacity for the virus than the acute serum, as shown by the protection of the mice from death or the prevention of the development of lung lesions. There is good evidence that in the case of influenza A infection this serological technique is more sensitive than the technique of recovery of virus by ferret inoculation. Francis (1940) states that cases of influenza virus B infection exhibit serological changes to virus B and not to virus A. Thus, even if a strain of virus is not recovered from a patient, examination of the serum for neutralizing antibodies should reveal whether A or B or neither virus was responsible for the infection.

During the winter, therefore, pairs of sera were collected from cases of respiratory infection and tested either by me or at Hampstead for antibodies to influenza viruses. Throughout the period serum was collected primarily from cases exhibiting a febrile respiratory illness with emphasis upon constitutional symptoms and with absence of signs of catarrh such as tonsillar exudate. During January and February, and especially when it

was known that an influenza virus had been isolated from garglings, serum was collected from cases which were representative, so far as possible, of the major number of febrile respiratory infections. A few patients with bronchitis or pneumonia and one or two with miscellaneous ailments were also examined at this time. Two of the four patients whose garglings were tested in December were cases of clinical influenza and these were examined serologically. Of four patients tested in March and April, two were cases of clinical influenza, one was a case of bronchopneumonia and one a catarrhal pharyngo-laryngo-tracheitis. Table I shows the results obtained with influenza virus A (P.R.8 strain).

TABLE I.—MOUSE PROTECTION TESTS WITH HUMAN SERA.

MONTH.	NUMBER OF SERA EXAMINED.	NUMBER WITH RISE OF ANTIBODIES TO VIRUS A.
December, 1940	2	0
January, 1941	34	27
February, "		
March, "	4	0
April, "		

From these results further evidence was obtained that influenza virus A infection was occurring in January and February, for twenty-seven of thirty-four pairs of sera collected in these months showed five-fold or better rises of antibody to virus A. Further, of these thirty-four sera, twenty-four were from cases with the symptomatology described in the first part of this paper as clinical influenza and twenty-two of these showed positive serological changes to virus A. The remaining five cases with positive serological findings consisted of three cases of influenza with bronchiolitis, one case of afebrile pharyngitis with general symptoms and one case of influenza with gastro-intestinal symptoms at the onset of illness. The seven cases with negative serological findings in January and February included only two with clinical influenza, two with bronchopneumonia, one with febrile relapse following influenza, one with vaccinia and one with tonsillitis and quinsy. The correlation, therefore, between clinical influenza and virus A infection in January and February was good.

Comparison between the isolation of virus and serological changes showed that the three patients from whom a virus was recovered either in the ferret or in the chick embryo exhibited sharp serological changes to virus A. Also, certain of those whose secretions yielded no virus showed similar changes (Table II).

TABLE II.—COMPARISON BETWEEN RECOVERY OF VIRUS AND SEROLOGICAL STUDIES.

MONTH.	CHICK TEST.		SERUM TEST (VIRUS A).	
	Number.	Result.	Number.	Result.
December, 1940	4	Negative	2	Negative
January, 1941*	4	2 Positive	4	4 Positive
		2 Negative		
February, 1941	4	Negative	3	3 Positive

*Three garglings tested in Ferret.—1 Positive.
2 Negative.

All sera positive in serum test with virus A.

It is clear, therefore, that recovery of virus by chick embryo inoculation was not found possible in several patients who nevertheless showed the typical serological changes of influenza virus A infection. It may be noted that three patients who showed good serological changes to virus A were also examined by ferret inoculation. Virus was only recovered from one of these patients. Either, therefore, the particular strains of virus A prevalent this year were particularly difficult to recover by the chick technique or the latter only succeeded in a low percentage of cases. The results obtained in ferrets by Dr. Andrewes certainly suggested that the 1941 influenza virus was less readily isolated in the ferret than usual and in his experience were thereafter more difficult than usual to adapt to mice.

Finally, the fact that no considerable number of our sera collected in January and February failed to show the serological changes of virus A infection suggested that influenza virus B infection was not present among the cases tested. Eleven sera which failed to show specific changes with virus A have been tested against virus B, but no instance of a rise of antibodies during convalescence has been encountered.

DISCUSSION.

So far in this paper only the investigation of cases of acute infection of the respiratory tract occurring this winter has been considered. Evidence has been presented that a minor increase in incidence of respiratory infection in January and February, which occurred in the absence of any general spreading epidemic in either Army or civilian population, was due to infection by influenza virus A. A general account of the clinical features of this infection has been given but no detailed analysis has yet been described. The value or otherwise of such an analysis is in comparison with similar analyses of cases of the same infection from former years and with cases known to be due to some agent other than influenza virus A. This year I have notes on twenty cases of febrile uncomplicated influenza proved by serological means to be cases of virus A infection. The symptomatology, physical findings, and course of the disease in these patients have been analysed and compared with the findings in twenty cases of virus A infection from the 1937 epidemic, and twenty from the 1939 epidemic. Diagnosis in these earlier epidemics had been made in nine patients solely upon the recovery of virus from the throat washings and, in the remainder, upon serological evidence accompanied also in four patients by the recovery of virus. The three groups of patients were drawn from patients in the Services of the recruit class and were of comparable age. No important clinical differences were found between the cases of virus A infection in 1941 and those of former years. The symptomatology as determined by the mode of onset and the frequency of occurrence of the various symptoms was similar except for a minor variation in 1939 when one-third of the patients complained of premonitory symptoms such as a cold, a cough or a sore throat for a few days before more general symptoms developed. Yet

even in 1939 the onset was judged to be acute in half the patients. The fever presented a similar course in the three groups being shortest in average duration in 1939 (two days), longest in 1937 (three and a half days) and of intermediate length in 1941 (three days). A diphasic or saddle-back temperature curve was seen in five patients in 1941, in six in 1937, but only in two in 1939. Similarly, bradycardia was less common in 1939 than in either of the other two years. Minor physical signs of chest involvement were found in six patients in 1941, in eight in 1937, but only in one in 1939. Thus, the 1941 and 1937 groups of patients resembled each other more closely than they resembled the 1939 group. Nevertheless, the differences were outweighed by the resemblances and detailed analysis supports a belief that in the last five years the ordinary febrile case of influenza virus A infection in the Services in Great Britain has been relatively constant in its clinical manifestations. It is essential to point out that this does not mean that all cases of virus A infection are clinically similar, for it is known that this infection may at times be subclinical or cause a mild nasopharyngitis and at other times cause a severe bronchitis or even pneumonia (Francis *et al.*, 1937 *b*, M.R.C. Report, 1938).

The fact that virus A influenza in different years has presented a remarkably similar nosology is, however, of little use in diagnosis if other cases of respiratory infection not due to virus A present a similar clinical picture.

TABLE III.—COMPARISON BETWEEN VIRUS A INFLUENZA AND NON-VIRUS A CASES.

				1937, 1939, 1941, 60 Cases of Virus A Influenza.	1939, 25 Cases of Non-Virus A.
ONSET.					
	Sudden	...	...	75 per cent	72 per cent
	With Constitutional Symptoms	...	...	60 " "	52 " "
	Premonitory Symptoms	...	...	18 " "	20 " "
SYMPTOMS.					
(a) Constitutional—					
	Malaise	...	...	87 per cent	60 per cent
	Headache	...	...	85 " "	80 " "
	Shivering	...	...	80 " "	76 " "
	Anorexia	...	...	71 " "	72 " "
	Muscular Pains	...	...	60 " "	20 " "
	Insomnia	...	...	38 " "	48 " "
	Dizziness	...	...	32 " "	28 " "
	Photophobia or Ocular Pain	...	...	20 " "	24 " "
	Sweating	...	...	17 " "	0 " "
	Vomiting	...	...	17 " "	24 " "
	Fainting	...	...	5 " "	4 " "
(b) Respiratory—					
	Cough	...	...	88 per cent	92 per cent
	Coryza or Nasal Obstruction	...	...	80 " "	76 " "
	Sore Throat	...	...	48 " "	60 " "
	Substernal Chest Pain	...	...	11 " "	32 " "
	Hoarse Voice	...	...	10 " "	36 " "
	Epistaxis	...	...	8 " "	4 " "
FEVER.					
	Average Length	...	...	3 days	2.5 days
	Diphasic Curve	...	...	21 per cent	8 per cent
	Bradycardia	...	...	27 " "	28 " "
	Tachycardia	...	...	20 " "	20 " "
ABNORMAL SIGNS IN CHEST				35 " "	44 " "

Such a group of cases was encountered in 1939 and clinical differentiation at the time was found to be impossible. A comparison of the notes of these 1939 non-virus A cases has been made with the combined sixty cases of virus A infection from the various years and is shown in tabular form in Table III. There are minor differences in symptomatology chiefly due to the occurrence of a laryngotracheitis among several of the 1939 cases, but on the whole the two groups are quite comparable. There is no diagnostic symptom or physical sign of virus A infection and one can only conclude with the rather sombre thought that virus A influenza does not present a sharply defined clinical entity. Perhaps the laboratory has furnished us with an explanation of this puzzling diversity of clinical influenza by proving the existence of two viruses—*influenza A* and *B*. It may be that the future will reveal the existence of not two, but a whole cluster of influenza viruses possessing different serological and pathogenic properties, yet sharing the property of that attack upon the mucous membranes of both upper and lower respiratory tract which manifests itself as clinical influenza.

In conclusion, I have been at some pains in this paper to turn away from the subject of prevention towards that of diagnosis—diagnosis of epidemiological events and diagnosis of individual ailments. This is because, in my opinion, we cannot hope to make considerable progress in our efforts at specific prophylaxis until we know more about the mode of occurrence of infection by the various influenza viruses. I have endeavoured to show how, in spite of the demands of wartime service, we have tried by varied methods of investigation to uncover the paths of infection taken by some of man's most inveterate parasites, the influenza viruses.

SUMMARY.

(1) A combined clinical and pathological study of cases of acute respiratory infection admitted to a Military Hospital during the winter 1940-41 is described.

(2) The recovery of two strains of influenza virus A by the technique of amniotic inoculation of developing chick embryos is recorded.

(3) Serological evidence is presented that a high proportion of the cases of clinical influenza occurring in January and February, during a slight increase in the incidence of respiratory disease, were cases of influenza virus A infection.

(4) The symptomatology of sixty cases of virus A influenza from various years is briefly reviewed in comparison with that of twenty-five cases of clinical influenza not due to influenza virus A which occurred in 1939.

ACKNOWLEDGMENT.

I am indebted to Lieutenant-Colonel H. T. Findlay, R.A.M.C., for permission to carry out the laboratory work in the laboratory under his charge and for his continued interest and encouragement.

I wish to thank Lieutenant-Colonel W. Stewart, R.A.M.C., Officer Commanding a Military Hospital, for permission to refer to patients under his care. I am deeply indebted to G. W. Dunkin, Esq., M.R.C.V.S., D.V.H., Director of the Field Station of the Agricultural Research Council, for kindly arranging for a supply of mice and fertile eggs without which this work would not have been possible.

REFERENCES.

- ANDREWES, C. H., GLOVER, R. E., HUDSON, N. P., LUSH, D., and STUART-HARRIS, C. H. (1941). *Lancet*. In press.
- BURNET, F. M. (1940, a). *Brit. J., Exp. Path.*, **21**, 147.
- Idem* (1940, b). *Austr. J. Exp. Biol., and Med. Sci.*, **18**, 353.
- ELFORD, W. J. (1931). *J. Path. and Bact.*, **34**, 505.
- FRANCIS, T., JR. (1937, a). *Amer. J. Pub. Hlth.*, **27**, 211.
- FRANCIS, T., JR., MAGILL, T. P., RICKARD, E. R., and BECK, M. D. (1937, b). *Amer. J. Pub. Hlth.*, **27**, 1141.
- FRANCIS, T., JR., and MAGILL, T. P. (1937, c). *Proc. Soc. Exp. Biol. and Med. Sci.*, **36**, 132.
- Idem* (1937, d). *Ibid* 134.
- HORSFALL, F. L., LENNETTE, E. H., RICKARD, E. R., ANDREWES, C. H., SMITH, W. and STUART-HARRIS, C. H. (1940). *Lancet*, **ii**, 413.
- STUART-HARRIS, C. H., ANDREWES, C. H. and SMITH, W. (1938). *Med. Res. Council Spec. Report Series No. 228*.
- STUART-HARRIS, C. H., SMITH, W. and ANDREWES, C. H. (1940). *Lancet*, **i**, 205.

ACUITY OF HEARING IN SEARCHLIGHT AND OTHER PERSONNEL REQUIRING GOOD HEARING.

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DUTIES which require good hearing for their performance require personnel with good hearing. Defects of hearing are of frequent occurrence in the normal population and in the "normal" soldier. Methods of testing at present in use fail to discover many of those with defective hearing. There is waste of time in training unsuitable personnel or a needlessly low standard of efficiency. An improved method of testing and selecting men is required.

These are the considerations which have prompted the preparation of this paper.

Medical categories in the Army permit men with substantial defects of hearing to be placed as high as A1. The A.C.I. of November 23, 1940, made it to some extent easier to deal with men with grave defects of hearing but left little changed or unchanged in the position of those with lesser defect. While it may be argued that this is inevitable when so many other factors of fitness and capacity have to be considered it would appear that considerable difficulty must arise when deaf men are posted to units or duties where keen hearing is necessary.

Many men whose hearing is considerably better than that which would place them in Category B6 (forced whisper from behind using both ears at less than ten feet) have difficulty, for example, when placed on night guard duty. But I have particularly in mind the case of men posted to Searchlight and similar units where, as air sentries or spotters or listeners, keenness of hearing is highly desirable.

As an otologist one has forcibly brought home to one the frequency of deafness. Moreover audiometric investigations of whole sections of the community, both in this country and in America, have shown that a substantial proportion of the "normal" population have impairment of hearing in a clinical or sub-clinical degree. In normal life some degree of deafness is often unnoticed; sounds are louder than they need be. For example, it will usually not be noticed that a man is deaf when he hears a conversational voice at only half the distance of a man with normal hearing. But a spotter or listener who only hears an enemy plane at half the proper distance will impose a severe handicap upon his searchlight or gun crew.

INVESTIGATION OF UNSELECTED "NORMAL" TROOPS.

With these considerations in mind I have examined one hundred unselected members of a Searchlight Training Unit. The average age of these

men was 25 years, varying from 19 to 37. Their Medical Category was for the most part A1, but a few were in lower categories, appropriate to the slighter degrees of defects of locomotion or ability to undergo severe strain. None was in category B6, the special category for the partially deaf. All these men were in training or had been trained as listeners or spotters, positions which require good hearing for spotters not less than for listeners.

Method of Examination.—Each man was asked in a sympathetic manner if he had ever had at any time any aural trouble. He was then similarly asked if his hearing was in each ear normal. The ears were then inspected with an electric auriscope; no attempt at treatment of any sort was made, the object being to determine the hearing prevailing and nothing else. In particular, cerumen was not removed although in a few cases it was responsible for deafness and in more cases it prevented a full inspection of the membrane. This will be referred to later.

The hearing in each ear was then tested with a Western Electric 6A pure tone audiometer, utilizing the frequencies 128, 1024, and 8192 cycles per second. Other frequencies were used if an unexpected result was obtained or to determine the abruptness of a high tone loss. Results were recorded in loss of hearing, decibels from the normal.

For the purpose of the analyses in this paper the hearing in each case was then classed as good, fair, moderate, poor or bad. For this the hearing for the 128 and 8192 frequencies was taken into account but chief importance was attached to the middle, 1024 cycle, frequency. This 1024 frequency is generally accepted as the tone which best (but by no means perfectly) indicates the hearing for common composite tones or noises. These standards, good, fair, etc., were entirely arbitrary but the average loss in decibels for the 1024 frequency for each was: Good, 3 dbs.; Fair, 10.5 dbs.; Moderate, 17.5 dbs.; Poor 27 dbs.; Bad, appreciably greater than 27, averaging 37 dbs. loss.

Each six decibels loss reduces the distance at which a sound can be heard by one-half, i.e., loss 6 dbs., hearing distance one-half normal; loss 12 dbs., one-quarter, loss 18 dbs., one-eighth, and so on. But caution is required in translating loss of hearing recorded in decibels into loss of hearing expressed in terms of the fraction of the distance at which the sound would be heard by a normal ear. Sound reflections and standing waves may upset the calculations and, very important, one must note that normal acute hearing is usually masked by background noise. The more noisy the place in which comparison is attempted and the less the degree of defect present, the more the comparison is made difficult. But the figures are useful to indicate the standards employed.

In the table appear the results of the investigation; it will be seen that 46.5 per cent of the ears tested could not be described as having good hearing. One should aim at a standard as high as reasonably possible but, if it be objected that the standard is too rigorous, it remains true that 24 per

cent of the ears tested had hearing which could not even be described as fair.

RESULTS OF INVESTIGATIONS.

100 Subjects — 200 Ears.

(Unselected spotters and listeners from a Searchlight Training Regiment.)

	Good.	Fair.	Moderate.	Poor.	Bad.
Individual ears, grouped according to <i>Acuity of Hearing</i>	107	45	14	24	10
	53.5%	22.5%	7%	12%	5%
Subjects with <i>Good Hearing in Both ears</i> ...	40%	—	—	—	—
Subjects with <i>Good or Fair Hearing in both ears</i>	69%	—	—	—	—
100 Subjects, grouped according to <i>Balance of Acuity of hearing in the two ears</i> (for the pure tones tested)	63	26	2	3	6
63 Subjects with <i>Good balance</i> (for the pure tones tested) <i>grouped according to acuity of hearing</i>	39	15	1	7	1
	62%	24%	1.5%	11%	1.5%

It will be observed that I have considered not only the actual acuity of hearing in the ears tested but also the apparent balance of acuity between the two ears in the individuals tested. The appraisal of this balance offers considerable difficulty when the pure tone audiometer is used and I doubt the value of the results given for this balance. This question which, of course, arises in the selection of "listeners" (sound-locators—S/L crews Nos. 7 and 8) will be considered again in the final section of this paper.

Relation of Findings of Hearing Defect to Subject's History and Statement.—

It is noteworthy that the presence or absence of a history of aural trouble is an unreliable guide to the hearing and that a man's statement that he has good hearing is also unreliable, particularly when the lesser degrees of defect are present. Thus of ten ears with bad hearing, nine were stated by the patient to be abnormal, of twenty-four ears with poor hearing only eleven, and of fourteen ears with moderate hearing only one was stated to be abnormal.

Place of Otoscopic Examination.—Otoscopy is essential. In a number of cases wax is causing obstructive deafness and the subject is quite unaware of the fact. In clinical otology it is usual only to remove wax if it is causing symptoms (irritation or deafness of which the patient complains) or in order to expose the membrane. In these men, whose duties depend upon their hearing, wax should be removed on sight if it is present in any appreciable quantity and certainly before it approaches the completely obstructive (deafness-producing) stage. For this reason the otoscopy should be repeated every three months.

Otoscopy will also reveal active aural disease and the residua of past middle ear disease, but if it is used as a basis to assess the hearing very large errors in both directions will occur.

Testing of Hearing.—That tests of hearing in current use fail to discover defects is well known, a fact supported by the results of this investigation. The conditions under which tests are conducted make for very wide varia-

tions in results and the interpretation of the terms "forced whisper" and "spoken voice" vary with the individual whim of the examiner, again varying the results which are still further varied by the vocal power and clarity of diction of the examiner.

The watch-tick gives results which vary very widely with the fluctuating conditions under which the individual tests are performed; moreover, the hearing for the very high frequencies of its components, is an unreliable guide to the hearing for lower frequencies.

The pure tone audiometer, used in this investigation, is an expensive instrument. It is perhaps needlessly accurate and tests with it are rather time-consuming. It does not lend itself to anything in the nature of mass-testing. Moreover, the hearing for pure tones is not necessarily that for composite sounds. While the 1000 cycle tone may be accepted as "representative" and the best indicator, it remains true that the best test stimulus is the sound which it is desired to estimate (as, for example, speech) or a reproduction thereof.

The Diminishing Speech Audiometer.—I suggest that a leaf be taken from the books of some of the more progressive Education Committees in this country and America who submit their children to routine testing of hearing by Diminishing Speech Audiometers. These are essentially gramophones producing series of words which commence at an intensity 30 decibels above the normal threshold and decrease in 3 decibel steps to an intensity below that threshold. The sound is led to the subjects by headphones and up to forty can be tested simultaneously. The complete test of both ears can be made in fifteen to twenty minutes and obviously the method is applicable to very large numbers. It makes a negligible call upon the intelligence of the subjects tested and all arrangements for testing and actual testing could be carried out by a specifically attached orderly.

The cost of these instruments approximates to £40, but I suggest that it might be possible to obtain instruments on loan for the duration of the war from Education Committees whose work is, at least in evacuation areas, at present to some extent curtailed.

Hearing for that very composite sound, speech, probably affords an excellent criterion for the hearing for other composite sounds but, in particular cases, as, for example, in the Searchlight Crews under consideration, there should be no difficulty in getting special sound records made—in this case the sound of an aeroplane, interrupted in very slow morse, decreasing in three decibel steps. A good balance of acuity in the two ears for such a test might well enable one to pick out initially the best potential listeners (7s and 8s) if, as may be the case, intensity differences, and not time lag or phase differences, is the important factor when sound locators are in use.

But the essential test for listeners is of the binaural sense and, for that test, it is probable that simultaneous binaural stimulation—as by the Savage Trainer—is necessary. Further work might lead to a test which would determine both the acuity of hearing and the binaural sense.

CONCLUSIONS AND RECOMMENDATIONS.

It can be accepted that efficiency will be increased if duties which call for good hearing are performed by men with good hearing.

It has been demonstrated that defects of hearing are frequent and that methods at present in use fail to discover them.

Men who are to undertake duties which particularly require good hearing should be subjected to a preliminary otoscopic examination and to tests of hearing by the Diminishing Speech Audiometer.

The otoscopic examination should be repeated every three months.

The audiometric testing should in the first place for a definite short period be on an experimental basis in a selected area. This would necessitate (1) an otologist who would in part of his time generally supervise the work and survey the results ; (2) an N.C.O., specifically allocated, who would conduct the tests and (3) a speech audiometer with the necessary supply of records and needles. Given facilities and aggregations of troops, one audiometer (which is readily portable) could be used for up to a thousand tests a week.

I wish to express my indebtedness to Colonel K. Comyn, M.D., late R.A.M.C. ; to Lieutenant-Colonel C. G. Darvey, M.C., R.A., and to Major W. F. J. Harvey, D.F.C., R.A.

From them I have received help but they are, of course, in no way responsible for the results, conclusions or recommendations.

THE SURGERY AT No. 3 GENERAL HOSPITAL.

AN ANÆSTHETIST'S VIEWPOINT.¹

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NO. 3 GENERAL HOSPITAL was the first and I believe the only general hospital in France that was entirely a tented one. The whole hospital, including the operating theatre and only excluding the pathology department, was under canvas.

The operating theatre tent was a marquee hospital, extending pattern. It consisted of three sections and two ends. There was an anæsthetic tent and sisters' duty room combined at one end of the theatre and a sterilizing room at the other. At first the floor of the theatre was merely a tarpaulin placed on the ground. This was very uneven and it was impossible to wheel tables and anæsthetic apparatus about. It was also very cold to stand upon. This floor was superseded by a boarded one. This was better but the heat of the theatre soon warped the unseasoned wood, and large cracks appeared that allowed the wheels of the tables to fall between them and dust to gather underneath. It would be well if all wheels for theatre equipment for use in the field were at least eight inches in diameter. This would permit them being moved even over rough floors. The last floor was a concrete and cement one covered with rubber linoleum stuck to the cement. This was perfectly satisfactory.

HEATING AND LIGHTING.

The heating of the theatre was a major problem. We experienced one of the most severe winters known in Northern France for some years. As an instance of this there were actually ice floes in the tidal part of the harbour at Dieppe, while the inner basin was covered with ice several inches thick. It cannot be said that we solved the problem of heating to our satisfaction. There were three coal stoves in the theatre and these were supplemented by Valor Perfection stoves. To begin with we had the Canadian type of coal stove. These were not satisfactory as it was impossible to rake them out without filling the theatre with dust. The Canadian type was superseded by the "dumpy" type. These stoves were shaped like two bee skeps fitted together, one inverted and the other not. They were an improvement but required a lot of attention and they also could not be raked out while operations were in progress. At the beginning of

¹ Reprinted, by permission, from the *British Medical Journal*, December 7th, 1940, vol. ii, p. 794.

a list they would be red-hot and then after an hour they would have spent themselves and the temperature in the theatre would fall from 80° to 50° F. very quickly.

The hospital extending marquee had a double roof and single walls. With single walls the lighting in the theatre was such that certain operations could be performed without artificial illumination. As the weather became colder it became necessary to put on double walls in order to maintain the theatre temperature. This made the theatre so dark that artificial lighting was always required. The lighting was at first by acetylene. We were not very successful with this, mainly owing to flakes of carbon forming on the burners that were inclined to fall down on to the field of operation. I understand that better results were obtained in the last war and if necessity had compelled us to gain more experience our results might have been better. The electric light was soon in operation. The light over the tables consisted of six 60-watt bulbs arranged round the circumference of a board 15 inches in diameter. The power was provided by a petrol engine that drove a dynamo. There were no accumulators. This lighting proved very satisfactory.

OPERATIVE ARRANGEMENTS.

The theatre was laid out with two operating tables at each end of the tent, and there was room for another in the middle in the event of a severe rush of work. Before operation most patients were transferred to one of two operation wards. These wards had fewer beds and extra nursing staff and were under the direct charge of the surgeons concerned. This greatly simplified the post-operative care of one's patients and was an altogether admirable arrangement. Patients for operation had to be taken to the theatre over sixty yards of rough ground, sometimes while snow or rain was falling, but operations were postponed when the conditions were particularly severe. Operations other than minor ones were also put off on windy days. It was found by exposing agar plates that the number of organisms in the theatre air rose considerably on windy days.

To mitigate the effects of the dust, Lieutenant-Colonel Ogier Ward and Lieutenant-Colonel Hayes devised a kind of bird-cage made of Cramer wire splinting, which was erected on the instrument table. This was covered with sterile towels and effectively prevented dust from falling on to the instruments. At first that conservative but indispensable body the nursing staff was inclined to scoff at this innovation but it proved its worth and at the end of a list an examination of the sterile towel on top showed the dust that would have fallen on to the table. A similar device is used by Mr. Hugh Cairns and the principle might well prove of value for routine operations even in the most modern theatre.

From the first the commanding officer and the consulting surgeon decided that under the existing conditions we were not justified in operating on knee-joints or in undertaking any major abdominal surgery except in

an emergency. The absence of serious post-operative complications undoubtedly justified this policy.

It will be seen that to a great extent we were the victims of circumstance but in spite of this up to the beginning of May, 1940, over 600 operations were done. After that time casualties began to arrive in steadily increasing numbers and my records of the last three weeks until the hospital was evacuated on May 20 are not complete. The operations were mainly for hernias, hæmorrhoids, ear, nose, and throat conditions and hallux valgus; cystoscopies were also performed. One brain abscess was successfully drained and a small number of acute abdominal emergencies were undertaken. Until May 1 operations for hernia numbered 95 of which 55 were performed under pentothal and N_2O and O_2 and 40 under spinal anaesthesia.

In December and January we had a certain number of post-operative chest complications. These were all of the same type. The patients ran a temperature of 99° to 100° F., for three or four days, with cough, some muco-purulent sputum, but no definite physical signs. None of these cases was serious and all cleared up. The incidence in this small series was confined to the operations for hernia and was slightly greater in the cases operated under spinal analgesia than in those done under pentothal and N_2O and O_2 . It is interesting that slight post-operative pulmonary complications were common in many of the hospitals in France during the winter, but later they almost disappeared. It is impossible to assess the causes accurately as so many factors were improved as time went on.

In general the anaesthetists were responsible for the arrangement of operating lists, for ordering the premedication and for ensuring that patients were brought to the theatre and taken back to the wards to time. I borrowed an idea from Professor Macintosh of Oxford: all patients who came to the theatre had a label attached to them on which were written their name, their ward, the nature of the operation, and the method of premedication and the time it was given. Before the patient returned to the ward the anaesthetist wrote on the back of the label the type of anaesthetic that had been given for the guidance of the sister in charge. This system was a great help in organizing the flow of cases and in seeing that they were returned to the right wards. It was particularly useful when more than one table was in use.

THE ANÆSTHETIC TECHNIQUE.

The routine premedication was omnopon $\frac{1}{2}$ grain and scopolamine $\frac{1}{150}$ grain. This was given one to one and a half hours before operation. At first omnopon was not available and morphine $\frac{1}{4}$ grain and atropine $\frac{1}{150}$ grain was employed. It was noticeable that the sedation was far more marked when omnopon and scopolamine was used. This was due to the absence of the stimulating effect of atropine which to some extent nullifies the action of the morphine. When a rapid effect was required the omnopon and scopolamine was given intravenously. This procedure was of great

assistance in emergencies and it is surprising that it is not more commonly adopted.

In most cases it was found preferable to induce the patient in the theatre as the passage between the anæsthetic room and the theatre was low and narrow. But for the difficulty of heating it might have been better for the theatre and anæsthetic room to be in one tent, divided by screens. In most cases induction was effected by 0.5 gramme of pentothal followed by N_2O and O_2 . For all operations except tonsillectomies this was all that was given. Ether was avoided, not so much because of the open fires but because it was felt that the good post-operative condition of the patients justified their occasional slightly suboxygenated appearance during the operation. As the time of operation wore on it was striking how much the oxygen percentage could be increased. When convoys of battle casualties began to arrive one observed the truth of Cannon's work in the war of 1914-18. These men had sometimes been forty-eight hours or more coming by ambulance train from the C.C.S. They were very tired as well as suffering from the effects of their injuries, and it was noticeable that a much higher proportion of oxygen, sometimes as high as 30 per cent, was required in anæsthetizing them with nitrous oxide and oxygen.

Some authorities have advocated continuous pentothal as the ideal anæsthetic for the field. From the foregoing it will be seen that I am not prejudiced against intravenous anæsthesia but I am certain that its widespread use for the shocked, or what Wesley Bourne calls the "handicapped," patient will show an unfavourable mortality rate compared with that following anæsthesia with nitrous oxide or cyclopropane.

The tonsillectomies had the nose and throat cocaineized and a dental prop inserted in the mouth before induction with pentothal. The insertion of a prop was important as otherwise the patient had to be carried to an unnecessarily deep plane of anæsthesia simply to relax the jaw sufficiently for the insertion of the Boyle-Davis gag. After 0.5 gramme of pentothal 100 per cent N_2O was given, a Magill's tube was passed, and the throat packed off with gauze soaked in olive oil. Anæsthesia was then continued with N_2O and O_2 . In some cases this sufficed but in most the patient was inclined to gag as the effect of the pentothal wore off. A small quantity of chloroform was added to prevent this.

The drugs available for spinal analgesia were 1 : 1,500 percaine and 5 per cent stovaine. Light percaine was used for the hernias and laparotomies that were performed under spinal analgesia. The Etherington-Wilson technique was usually employed. All the hæmorrhoids and some of the cystoscopies were anæsthetized with 5 per cent stovaine. For these operations, what Maxson called the "sitting bull" method was employed. The patient was sat up and 1 c.c. of stovaine given, the patient being kept sitting for three minutes. This method is admirably suited to these operations. It was observed that the "Army back" was an easy one on which to perform spinal puncture. The lateral approach was tried, and eventually

became the method of choice. This is favoured more in the United States than here. By avoiding the tough intraspinous ligament one is less liable to bend a fine needle, and it eliminates the need for a Sise introducer.

The Trendelenburg operations for varicose veins were all done under local anæsthesia. One brachial plexus block was performed following Patrick's technique and was quite successful but the scope for this method seems very limited.

CONCLUSION.

Only a few days before the hospital was evacuated we moved into the new hutted theatre. This was not finished but we were compelled to take this step owing to the difficulty of "blackening out" a tented theatre while working at night with adequate lighting. Even in its unfinished state this theatre was a great improvement on the tent and served to throw into relief the disabilities under which we had worked for the previous six months. However I hope I have shown that what one might call medium surgery is possible in a tented theatre without any sacrifice of professional standards. Unfortunately we were only to enjoy the new theatre for a few days before evacuation was ordered. It was most depressing to leave the hospital which one had watched grow from the time when there was nothing but a bare and exposed field and in which one had worked through a long and severe winter ; but we left much richer in experience than when we arrived in the middle of September, 1939.

I must thank my commanding officer, Colonel A. L. Foster, for reading the proofs and for his permission to publish this paper.

PATHOLOGICAL EVIDENCE AS TO THE CAUSATION OF HÆMATURIA FOLLOWING SULPHAPYRIDINE THERAPY.

BY MAJOR N. T. WHITEHEAD, *M.C.*,

Royal Army Medical Corps.

THE recent death of a patient under treatment with sulphapyridine has provided an opportunity for investigating the excretion of this drug from the body and the cause of the hæmaturia which occasionally occurs during such treatment.

The case under review was that of a man aged 30 who was admitted to hospital with a non-specific urethritis. He was given an intensive course of sulphapyridine but after receiving 17 grams in forty hours he complained of pain in the loins and the treatment was stopped. His output of urine began to diminish and the flow eventually ceased altogether. The urine contained blood and needle-shaped crystals of acetyl sulphapyridine. On the day of the patient's death the concentration of urea in the blood rose to 300 mgm. per 100 c.c.

I propose to give only a brief summary of the post-mortem findings and then to describe in greater detail the microscopic appearance of such tissues as have a bearing on the subject.

The kidneys were both enlarged (right 8½ ounces, left 9 ounces) and there were a number of subcapsular hæmorrhages on the surface. When split open the medullary regions were seen to be much congested.

The ureters were greatly dilated and contained a thick dark-brown fluid. The ureteric openings in the bladder were both blocked with "altered" blood and were surrounded by a ring of sub-epithelial hæmorrhage. Along the course of the ureters were a few small bleb-like swellings full of blood and they were present even more noticeably in the wall of the renal pelvis.

The rest of the abdominal organs were examined, but no abnormalities were found. The lungs were congested and œdematous.

Death was due to blockage of both ureters with subsequent uræmia.

We now pass to the microscopical appearances. The contents of the ureters consisted of hæmolysed blood, epithelial cells, leucocytes and blood pigment. None of the typical sulphapyridine crystals were seen, but some small crystals were present which were round or oval in shape and had a rough surface. Their size was about 30 microns.

The most noticeable feature in the sections of the kidneys were the extravasations of blood which had taken place in the medullary regions. Throughout this area multiple hæmorrhages had occurred, some being a little bigger than a glomerulus whilst others were large enough to be seen with the naked eye.

Blood was also observed tracking down towards the hilum of the kidney both inside and outside the tubules. The blood which flowed down *inside* the tubules passed into the ureters, whereas the blood that had made its way *between* the tubules tended to collect in the connective tissue surrounding the calyces and the renal pelvis.

Another point of some interest is that in almost every section of the kidney which was examined small crystals were to be found very similar in appearance to those already seen amongst the contents of the ureters.

These crystals were situated inside the tubules, in the surrounding interstitial tissue and in the hæmorrhagic areas. In some instances the crystals could even be seen in the process of being forced through the wall of the tubules.

The size of the crystals varied between 15 and 30 microns and their shape was usually round or oval, though sometimes small projections and outgrowths gave them a more irregular appearance. Their surface was rough and often indented by deep clefts down which fractures could easily be produced by light pressure on the coverslip. Such treatment broke up the crystals into a number of sharp-pointed, wedge-shaped forms. Cross-sections showed the crystals to be very finely striated, often with the addition of minute spicules on the surface. This is well shown in fig. E, especially if use is made of an ordinary hand lens.

There appears to have been some inflammation of the glomeruli as evidenced by the increased number of nuclei in the tufts of the kidney and the swelling of the endothelial cells lining the glomerular spaces. In some cases these were so large as to look much more like epithelial than endothelial cells.

The cells lining the tubules showed signs of degeneration and the interstitial tissue of the kidney was markedly œdematous.

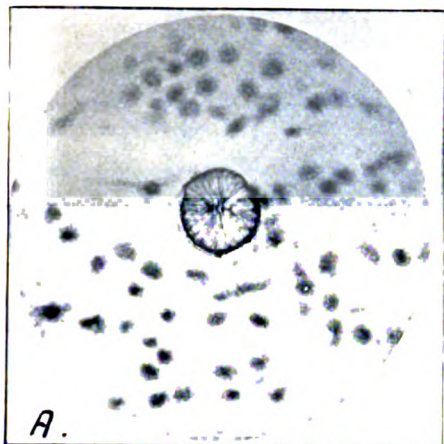
Sections through the bleb-like swellings in the ureters and in the wall of the renal pelvis showed sub-epithelial hæmorrhage, œdema and well-marked round-cell infiltration.

COMMENTS.

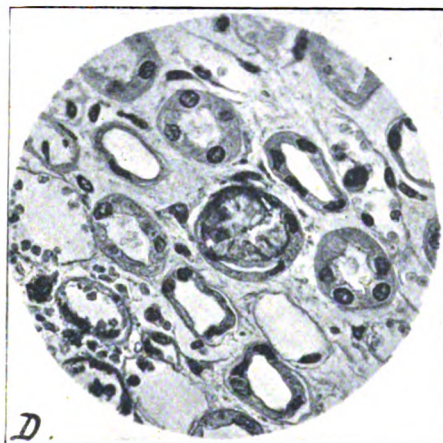
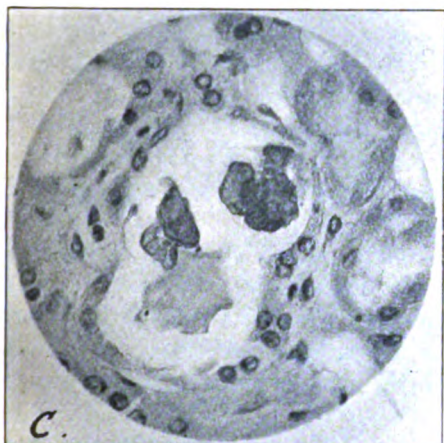
Several points of interest arise from the foregoing observations. What, for instance, caused the blockage of the ureters? Where was the chief site of the hæmorrhage, and could the crystals described have been the cause of it? Lastly, what is the composition of these crystals?

Contrary to the findings of some other observers, there were no concretions blocking the ureteric orifices in this case. The ureters, as they passed through the wall of the bladder, were markedly narrowed owing to the extensive sub-epithelial hæmorrhages in this region. This narrowing of the terminal part of the ureter added to the sludge-like condition of the blood descending from the kidney amply accounts for the blockage of these passages.

The chief site of the hæmorrhage was in the central medullary regions



- (A) Cross-section of a crystal showing striæ radiating from the centre.
 (B) Crystal of sheaf-like form. Note the striæ radiating from the centre and the beginning of a fracture originating in the upper pole.



- (C) Two crystals in a tubule. The one on the right has not been cut and shows the rough outer surface.
 (D) A crystal is here shown completely filling a tubule.



- (E) This crystal lies on the edge of the hæmorrhage. The section has been carried only half-way through the crystal, the outer edge of which shows minute spicules.
 (F) A crystal in the process of breaking up into wedge-shaped segments. Note the thinning of the wall of the tubule at one end.

of the kidneys. That the crystals were the cause of the hæmorrhage is supported by the evidence of a number of the histological sections. These showed the crystals passing through the tubular walls and damaging the blood capillaries in the process.

The small sub-epithelial hæmorrhages in the walls of the ureters were probably caused by the crystals which had had an uninterrupted journey through the kidneys and were on their way to the bladder.

The sub-capsular hæmorrhages were undoubtedly a toxic manifestation.

With regard to the composition of the crystals there are three main forms described as appearing in the urine of patients receiving sulphapyridine : (1) Lenticular-shaped crystals ; (2) sheaves of needle-like crystals ; (3) wedge-shaped, striated crystals.

Backhouse has stated that the lenticular form is the one most usually seen. In one case he found that after a day or so the lenticular form was replaced by an occasional needle sheaf. He also points out that the urine was often passed clear but deposited these crystals on standing.

O'Meara made similar observations and noticed that as the number of crystals decreased there was a relative increase in the needle sheaves.

Smith, Evelyn and Nolan noticed amorphous, spherical aggregates in addition to the sheaf-like type of crystal.

Plummer and McLellan describe a wedge-shaped striated variation.

The crystal I have described does not correspond with any of these forms though fig. B has some resemblance to a sheaf of very tightly-packed needles. We have seen, however, that the sulphapyridine appears in at least three types and that a patient's urine may contain crystals of more than one of them.

In the case under review needle-sheaf crystals did appear in the early stages of the treatment and it seems highly probable that the minute crystals herein described supply yet another variation of this substance. It would besides be reasonable to expect a crystal formed in the confined space of a renal tubule to differ both in size and structure from one precipitated in the urine "on standing," or even in the comparatively roomy and commodious renal pelvis.

My thanks are due to Dr. R. Forgan for much helpful information and also to Colonel H. L. Howell, *O.B.E.*, *M.C.*, the Officer Commanding, The Royal Victoria Hospital, Netley, for permission to publish this article.

REFERENCES.

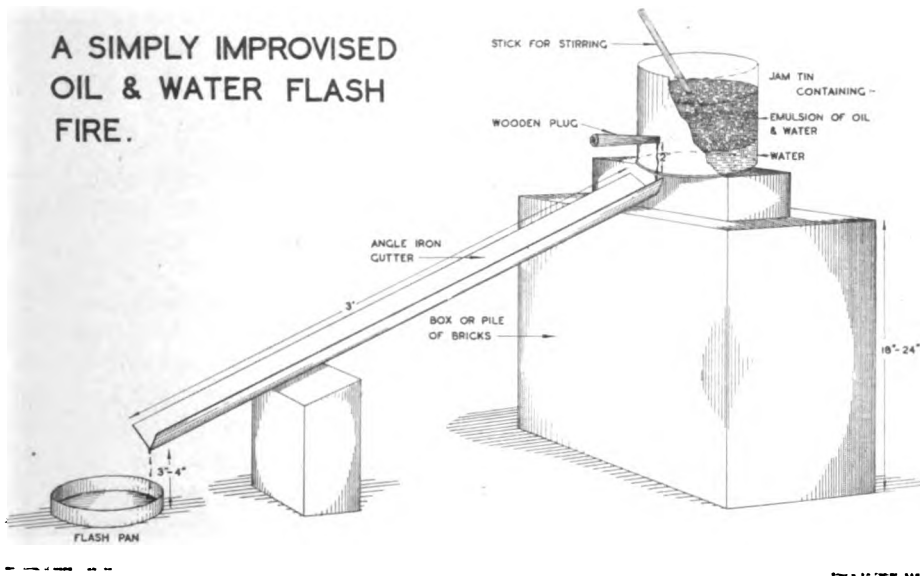
- BACKHOUSE (1939). *Lancet*, **2**, 736.
O'MEARA (1940). *J. Roy. Naval Medical Service*, **26**, 3 July, 284.
PLUMMER and McLELLAN (1940). *J.A.M.A.*, **114**, 17, March 16, 943.
SMITH, EVELYN AND NOLAN (1940). *J. Canadian Med. Ass.*, January, 27.

A SIMPLY IMPROVISED OIL AND WATER FLASH FIRE.

By MAJOR G. J. SUMMERS,
Royal Army Medical Corps.

AN oil and water flash fire is a means of utilizing waste oil from mechanical vehicles when it is no longer suitable for lubricating purposes. As a method of supplying heat for field kitchens and improvised steam disinfectors it has proved both economic and successful.

Experiments have been carried out recently at the Army School of Hygiene with a view to evolving a fire of this type which would be within the powers of any unit to make and use. It is essential, therefore, that the materials required should be easily obtainable and as easily adapted to the



purpose. The simple improvisation here described can be made in a few minutes from two 7 pound jam tins, a 3-foot length of scrap angle-iron, and a piece of wood. It was found that stirring up sump-oil with water produces a mixture which burns on a flash-pan with a hot crackling flame ; separate reservoirs for oil and water can thus be replaced by a single fuel container.

The fuel container is made by piercing a hole in the side of a jam tin about 2 inches from the bottom and plugging this hole with a tapered wooden peg. Cutting away the sides of the second jam tin not more than 1 inch from the bottom provides a flash-pan and completes the work of preparation.

The following procedure is suggested for men who have had no previous experience of an oil and flash fire.

(1) To prepare the fuel mixture : (a) Remove the wooden peg from the fuel tin and pour in water to the level of the outlet hole ; (b) plug the hole with the peg and fill up with sump-oil ; (c) Stir briskly for half a minute with a thin stick. (Excess water will quickly settle to the bottom of the tin and be trapped below the level of the outlet.)

(2) Place this tin on a box or a pile of bricks 18 inches to 2 feet above the level of the flash-pan and arrange the 3-foot length of angle-iron with its lower end 3 or 4 inches above the flash-pan. (See diagram.) The tin containing the fuel mixture should be on an even keel.

(3) Start the fire in the flash-pan by lighting a small rag soaked in oil.

(4) Loosen the wooden peg and allow a thin stream of fuel to flow down the gutter. By the time the fuel reaches the flash-pan the temperature there should be found to have reached flash-point.

A little practice will soon indicate how the flow of fuel may be regulated to give the best result. If it is noticed that ignition is taking place on the lower end of the gutter and that fuel is not reaching the flash-pan, the amount of fuel being fed to the fire should be increased.

My thanks are due to Colonel E. B. Allnutt, *M.C.*, Commandant, Army School of Hygiene, for permission to forward these notes for publication.

THE DETECTION OF HYSTERICAL BLINDNESS OF ONE EYE.

BY MAJOR W. RITCHIE RUSSELL, M.D., F.R.C.P.ED., M.R.C.P.,
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OPHTHALMOLOGISTS have many ingenious methods for demonstrating that loss of vision in one eye is due to hysteria or malingering. Most of these tests, however, require apparatus which only the specialist can use. The method described below can be used accurately by any medical officer and the apparatus required costs only three or four shillings to construct. Provided that the defect in vision affects one eye only, the method will detect accurately both marked and slight degrees of functional loss of vision.

The main requirement is a pair of red and green "spectacles," one "lens" being of each colour (fig. 1). Thin coloured celluloid is suitable

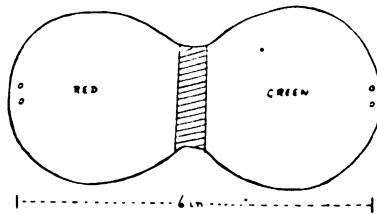


FIG. 1.—To show the shape of the "spectacles."

for constructing the lenses and each should be about 3 inches in diameter so that they cover the eyes completely. Glue or rivet the red and green lenses together to make a pair of "spectacles" and attach the ends of a piece of thin elastic to each edge which, when stretched round the patient's head, will hold the spectacles in position. They must be made so that they can be worn reversed.

The coloured material for the "lenses" must be carefully chosen. Black print should be visible with equal facility through each lens, or better, the red lens should be darker than the green: a double piece of red celluloid may be required to give the necessary effect. Writing in clean red ink should be invisible when viewed through the red lens.

It is now necessary to construct two sight-testing cards which, in most respects, are identical. Filing cards (8 by 5 inches) are convenient for this purpose. Each card may have three rows of test letters, convenient sizes being $\frac{1}{2}$ inch letters for the top line, $\frac{3}{16}$ inch for the second and $\frac{2}{16}$ inch for the third line. The "12," "9" and "6" lines on Snellen's test card may be copied for this purpose.

For card No. 1 the letters are painted with a fine brush using ordinary blue-black ink. For card No. 2 the letters are exactly the same as in card No. 1 but, in this case, about half of the letters in each line are painted in clean red ink and are therefore invisible when viewed through the red lens.

It is essential that the red letters are drawn with a perfectly clean brush and that there is no preliminary drawing with pencil as a pencil outline is very difficult to remove completely with rubber. If the test cards are correctly prepared the red letters on card No. 2 are invisible when viewed through the red lens even in a bright light. If they remain faintly visible carry out the test in a slightly subdued light. Further, when viewed through the green lens, the black and red letters appear to be of approximately the same colour and strength.

The test is carried out as follows :

The examiner's attitude is such that the patient has no reason to think that a crucial test is being carried out and the test cards are at first concealed lest the patient should memorize the letters. The spectacles are applied so that the *red lens covers the good eye* (they may be worn over the patient's own glasses). The patient sits with the defective eye towards the light so that the examiner can observe any attempt to close this eye voluntarily. The defective eye is now covered by an assistance and test card No. 1 (black letters) is supported on a table at a distance from the patient which is less than the maximum at which he can read the bottom line. With the card supported in this position the good eye is now covered and the vision, if any, of the defective eye noted. This part of the test is carried out quickly lest the patient should learn all the letters by heart.

The patient is now asked to read out the letters of the bottom line while both eyes are open which, of course, he can do easily. The examiner then says : "Now we'll have the same line backwards." but while saying this he unobtrusively (pretending perhaps that the card is slipping) changes the cards so that the patient is now reading card No. 2 some letters of which are red. A cunning patient may now hesitate and may close the bad eye to find out what he ought to see, but this subterfuge is easily observed and the patient is pressed to keep both eyes open and to continue reading without delay.

When the loss of vision is due to hysteria or malingering, both red and black letters on the bottom line will be read correctly, whereas if the loss of vision is genuine only the black letters are visible.

When the red letters have been read aloud, thus indicating that the blindness is functional, the examiner may now say : "That is very good, for you are reading many of these letters with the eye you thought was bad. If we close the bad eye you will see that many of these letters are invisible." The examiner now covers the bad eye himself and keeps it covered while the patient tries to read the letters. While still covering the "bad" eye he may press the patient to admit that the sight of this eye must be good and may encourage him to read the bottom line again. He can now, of course, only see the black letters and, if he reads the red letters, he must have learnt the line by heart. It is unlikely, however, that he can repeat all three lines, both forwards and backwards, from memory.

The further treatment of hysteria or malingering does not come within the scope of this note.

Editorial.

THE SUDAN AND ITS HEALTH PROBLEMS.

WE have before us the Report of the Sudan Medical Service for the year 1939 and, owing to the fact that British and South African troops may have been affected and medical events there as well as those of the Abyssinian provinces adjoining are being brought so near to us, we feel that it should receive notice from the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

When, in 1898, the British and Egyptian Armies under Sir Herbert Kitchener defeated the Khalifa and his hosts and finally occupied the Sudan, they found a vast land totally without any of the medical requirements of civilization. The population, too, was of a type to be gradually won over by military surgeons rather than placed at once under the care of civilians.

Thus it came about that the medical officers of the Egyptian Army, stationed where troops were in occupation, were called upon to shoulder the burden of treating civilians either in the same or in neighbouring hospital shelters to those allotted for military use.

Although the conditions were at first primitive, justifying the expression "hospital shelters," rather than the more pretentious term "hospitals," the civilians were very well looked after and the confidence of the wild and suspicious natives was rapidly won. At the same time, civilian doctors were gradually introduced and, though they were given rank in the Army and were used for military as well as civil duties, they gradually took over the civilian patients, at first those of the larger cities, then more slowly the people of the outlying and provincial districts, and became the founders of a whole-time service. The need for an Egyptian Army, with British Officers in the more senior posts, became less and less urgent as the Sudan became more and more divorced from Egypt; and the Sudan Defence Force, really a police force for local use, served by the civilian doctors of the Districts, gradually took its place. Thus came into being the Sudan Medical Service with a Director (at present Mr. E. D. Pridie, *D.S.O.*), two Assistant Directors, a Registrar for the School of Medicine, five Consultants and a number of medical men and surgeons, to say nothing of such Research Institutions as the Stack Medical Research Laboratories, the Medical Entomology and the Wellcome Chemical Laboratories, the Kitchener School of Medicine and a Graphic Museum. And, if we may be allowed to say so, the whole of the Research side still appears to owe a great deal to the energy and initiative of its first Director, the late Sir Andrew Balfour, as well as to that of his excellent successors.

The Report before us makes no attempt to assess the numbers of the populations involved. The Sudan is a vast area with a large number of nomadic tribes as well as certain fixed and semi-fixed communities and any accurate estimate would appear to be impossible at present ; moreover the numbers actually suffering from any one disease are often very hard to obtain. Some idea of the work of the Service, however, may be gained from the fact that 105,103 persons were treated in the hospitals during 1939 with 2,373 deaths and 7,119,973 persons received out-patient attention.

It is interesting, as an indication of the fierce and undisciplined nature of the population, that no less than 18,233 of those admitted to hospitals (of which 242 died) were suffering from "wounds and other injuries," while 589,321 similarly afflicted persons attended as out-patients ; the highest total of any condition. Syphilis came next with 17,680 in hospital, while the same disease led to 88,879 attendances ; and there were the usual diseases of a tropical climate, malaria with 9,393 admissions and 91 deaths, yaws, Leishmaniasis, filariasis, Guinea worm, tropical ulcer, madura foot, leprosy, undulant fever, amœbic dysentery, rabies, pellagra, &c. In addition, there were the more common diseases of all climates, diseases of the respiratory and digestive tracts, of the genito-urinary system, as well as tetanus, whooping-cough, pneumonia, and smallpox. Research work has, of course, been a prominent feature and there is much to be said about it. Recent work in the Sudan suggests that the Negri bodies in rabies are essentially a defence mechanism of the cell and not colonies of virus. "It is difficult" (if they are virus colonies) "to see why they should be present in varying numbers in one animal species but absent in another although, in both, the behaviour of the virus is absolutely typical." Investigations into the subject of kala azar have been steadily pursued. The distribution of thirteen species or varieties of sandflies has been established, six of them belonging to the subgenus *Phlebotomus* Parrot. Infection of the skin has been demonstrated in a high proportion of cases making it probable that the vectors may take up the parasites from this tissue rather than from the blood. It is thought, therefore, that the lymphatics may play a large part in the spread of infection through the body and the frequency with which the diagnosis is now confirmed by gland puncture is thus more readily understood. The presence of Vi antigens was sought in the few cases of typhoid fever met with but the investigators failed to confirm that this method was likely to be of use in the Sudan. We should prefer to suspend judgment on this point until a larger number of persons have been tested. Of mannite-fermenting organisms, 37 strains were tested, of which six were Sonne and the remainder belonged to the Flexner group. The latter were typed according to the recent classification of Boyd 1938.

"Thirty strains fell into the V-Z group and two inagglutinable ones appeared to be identical with the type D 1 of Boyd."

In mosquito surveys, attention is being given to the Jebel Aulia reservoir with the object of observing the changes in mosquito fauna consequent on

the gradual rise of the reservoir level. In the Upper Nile *Anopheles funestus* is abundant as far north as Renk although in the reservoir area not a single specimen has been found. "The possibility of a northward spread of this dangerous species cannot be regarded as impossible." During the annual survey, 4,074 specimens of *Aedes Aegypti* and 1,552 of other species of *Aedes* were received. We have recently had news of a severe outbreak of yellow fever in the Nuba Hills. This large-scale epidemic will, doubtless, receive much notice in the next issue of the Annual Report of the Sudan Medical Service.

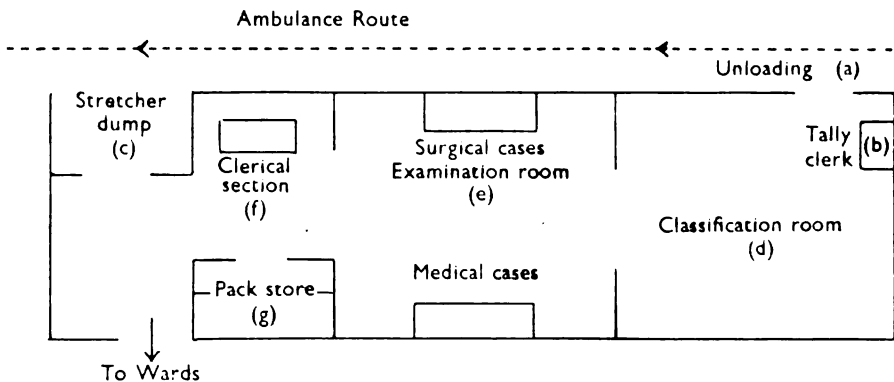


Clinical and other Notes.

NOTES ON THE ORGANIZATION OF A RECEPTION ROOM IN A GENERAL HOSPITAL ON ACTIVE SERVICE.

BY MAJOR E. J. G. GLASS,
Royal Army Medical Corps.

CASUALTIES reaching a General Hospital on active service generally arrive as a convoy either by Hospital Train or by M.A.C. Thus a large number of cases will reach the reception room in a relatively short time and, should the organization of that department fail, chaos will inevitably result. Doubtless there are many ways in which this risk can be minimized, and neither perfection nor originality are claimed for the following scheme. In its favour it can be said that it stood the test of practical application, and a convoy of roughly one hundred patients passed through to the wards with a time lag of less than two minutes per case in a General Hospital in the B.E.F.



Sketch plan of reception room.

Reference to the sketch plan will be made throughout the description to clarify the text. Briefly there were three sections; unloading and classification, examination and allocation, and clerical. Each section was clearly defined and no overlapping was permitted; every case admitted, serious or trivial, went through the same routine so that there was no risk of missing any essential detail or of patients being admitted without all particulars being recorded.

UNLOADING AND CLASSIFICATION SECTION.

Unloading.—All arrangements for traffic control, unloading of ambulances, exchange of stretchers and blankets, and detail of stretcher squads (including

bearers employed in taking cases to the wards after examination), were under the control of an officer detailed for this duty.

Ambulances unloaded at the entrance (A) and patients were carried into the classification room (D) by a waiting stretcher squad. Just inside the entrance (B) an orderly was stationed to check the number of stretchers and blankets brought in. Tallies, triangular for a stretcher and square for a blanket, were given to the ambulance orderly in exchange for each. When unloaded the ambulance drove on to the Stretcher Dump (C) where the tallies were handed in and the corresponding number of stretchers and blankets issued in exchange. The ambulance, now re-equipped, proceeded on its way.

Classification Room.—The classification room (D) was under the control of a general duties officer (normally the orderly officer) with a staff of one nursing sister and two orderlies. Field Medical Cards (A.F. W.3118) were examined and cases divided into "Surgical" and "Medical." A supply of spring clothes-pegs, coloured red for surgical and white for medical, were used to identify the cases classified. With these pegs the Field Medical Card was attached to the clothing. The more serious cases were further segregated by being placed nearest to the entrance of the examination room.

Facilities were available for giving morphia or hot drinks, as required, and any minor attentions to increase the comfort of the patients could be carried out. The giving of morphia was indicated by writing with skin pencil on the forehead noting time and dosage.

EXAMINATION AND ALLOCATION SECTION.

Examination Room (E).—Two examination tables were available under the direction of the heads of the Surgical and Medical Divisions respectively. On being carried into the room the case was directed to the appropriate officer as indicated by the colour of the attached peg. Only a brief examination, sufficient to assess the type and the severity of the case, was made and a brief note made on the Field Medical Card.

Facilities for dressing wounds, administration of morphia, etc., were available but, wherever possible, this attention was given after the patient had been admitted to the ward.

Allocation.—Although manifestly impossible to reserve wards for special types of case, an endeavour was made to allocate similar types of case to the same ward, for example fractures, abdominal wounds, etc. A Bed-State Board was used by means of which it was possible to keep a continuous record of the vacant beds. A label denoting the ward was clipped to the clothing with the Field Medical Card serving as an "address" to which the patient was to be delivered by the stretcher bearers. Full details of the Bed State Board and the labels will be given at the end of this note, but it may be stated here that this proved the most valuable single factor in the scheme.

Clerical Section (F).—As the patient was being taken from the Examination Room to the wards he passed through the Clerical Section. Here details were taken from his Field Medical Card by an orderly and noted by the A & D clerk, supplementing the information where necessary by such information as the patient could give. The Case Card (A.F. I.1220) and diet sheet, etc., were made out at the same time and clipped as before to the patient's clothing along with the Field Medical Card and label. A second clerk made out the Card Index card and filed it for record purposes.

Simultaneously the Pack Store staff (G) collected such clothing and equipment as could be taken without further embarrassing the patient. Ward clothing was not issued here; in order to avoid delay a set of these necessities was issued for each vacant bed and laid out in the ward.

Leaving the Clerical Section the patient was taken over by a stretcher squad (or guide if walking) and conducted to the appropriate ward where arrangements were made for operation or treatment by the ward medical officer. The stretchers and blankets were brought back to the Reception Department by the stretcher squad and deposited on the dump ready to be used as replacements for discharged ambulances.

Throughout the reception period R.A.M.C. personnel were not employed as stretcher bearers except in the rooms. Stretcher squads for unloading and for carrying patients to the wards were supplied by the A.M.P.C. and it is a pleasure to record the efficient and gentle manner in which they carried out this task.

Bed State Board.—In order to keep touch with the rapidly changing bed state, special boards were prepared for the Surgical and Medical Divisions. On the board were marked the index number of each ward, the type of case for which equipped, the number of beds and the name of the ward officer, for example :

Ward B.3.		Ward B.4.	
Fractures.	Beds 24.	Resuscitation.	Beds 16.
Major Black.		Capt. White.	

Beneath these data was a hook on which were hung a series of labels corresponding in number to the number of beds in the ward. Each label was marked with the index number of the ward and beneath it the number of the bed. Printing in red indicated a surgical and in black a medical ward.

The labels were hung up in numerical order beginning with No. 1. The board was checked daily or oftener by the ward-master's staff, and a number of labels removed from the hook corresponding to the number of occupied beds in the ward. The bed number on the top label then indicated the number of unoccupied beds in the ward. As the labels were removed to act as "addresses" the bed state was automatically kept up to date. It will be obvious that inter-ward transfers must be notified to the Reception Department in order to have the bed-state corrected.

The writer wishes to disclaim any credit for the organization described above. The main credit belongs to Captain R. Chignell, R.A.M.C. The writer also wishes to acknowledge with thanks the permission of Colonel H. A. B. Whitelooke to record these notes.

THE TREATMENT OF VARICOSE VEINS IN THE SERVING SOLDIER.

BY CAPTAIN B. McN. TRUSCOTT,
Royal Army Medical Corps.

VARICOSE veins cannot be described as a severe disability but they can cause marked inconvenience and render a man, otherwise perfectly fit, incapable of prolonged standing or marching. Effective treatment will result in a considerable saving of man power.

Simple injection of a sclerosing solution into the vein has become the method most practised in recent years. The course of treatment is prolonged, however, and the results often unsatisfactory if the case is more than a slight one.

The technique of ligature and injection described below is slightly more drastic. In severe cases it is the minimal procedure likely to give a good result and in cases of a moderate degree it is the most economical procedure. The end result is attained with little disturbance to the man and his unit.

No claim is made that the technique described below is original. It is the routine followed which has given the best results in the shortest time. The purpose of this paper is to attempt to show that any case of varicose veins can be simply and effectively treated by this means, rendering the patient fit for full service.

Since November, 1939, over fifty cases of severe varicose veins have been treated. There was no obvious predisposing factor in the past history of the majority. This supported the belief that some congenital factor was the basic cause.

In every case the lesion had deteriorated or become evident with active service conditions. These conditions of necessity include two factors which rapidly demonstrate underlying weakness, namely, marching and prolonged standing. Several of the patients had had previous injection treatment which had resulted in sufficient palliation for civilian occupation but not for active service. Symptoms included aching in the calf, swelling of the feet, pigmentation and ulceration. In a few cases the actual disfigurement of a grossly dilated vein was the sole complaint.

Minor cases were treated by simple injection. Certain positive findings were considered essential before ligation and injection were undertaken. These were: (a) varicosities which could be controlled by pressure on the

internal saphenous vein in the thigh; (b) a positive Trendelenburg test; (c) a severer degree than a few superficial dilated veins. Ulceration was not considered a contra-indication. Despite the brisk reaction following treatment healing of the ulcer was always speeded up and often complete in seven days.

The object of the operation was to tie the internal saphenous vein and inject a large quantity of sclerosing fluid into the distal end. The ligature prevented any likelihood of recurrence or recanalization in the thrombosed veins. The clots organized and finally fibrosed to form a hard painless fibrous cord. The sclerosing fluid used was 2½ per cent sodium morrhuate. The quantity varied between 6 and 12 c.c. depending on the severity of the case.

The patient was seen by the Surgical Specialist as an out-patient. If considered a suitable case admission was arranged. A patient arriving in the ward before 1200 hours was operated on the same afternoon. If admitted later he waited until next morning.

The skin of the affected leg was shaved from groin to knee and prepared in the usual way with surgical spirit or iodine. The patient walked from the ward to the theatre. This allowed the internal saphenous vein to become well dilated. He stood in a good light and the vein was marked on the skin with a slight needle scratch at the site selected for ligature. This must be done before getting the leg in position on the table. A collapsed vein is difficult to find. Marking with iodine or methylene blue was unsatisfactory because subsequent swabbing with spirit rendered it faint. The vein was tied in the upper third of the thigh just above the point at which the internal and external circumflex veins join it. About 1½ inches of skin were anæsthetized with 1 c.c. of 2½ per cent novocain. An incision 1 inch long was made in the line of the vein, ½ inch of which was isolated and cleaned. A ligature was placed and tied around the proximal end. The first knot of another ligature was tied loosely around the distal end.

After placing a swab under the vein a small nick was made and the nozzle of a charged syringe slipped into the lumen. The first knot of the ligature was tied tightly around the syringe to prevent leakage. After injecting the sclerosing fluid the syringe was removed and the second knot of the ligature finally tied around the distal end of the vein which was cut right across. Care was taken during injection that no fluid escaped into the wound. In this way the troublesome and painful complication of local ulceration was avoided. The incision was sutured and a dressing applied. Massage in a downward direction dispersed the fluid to the lower parts of the leg.

The injection was followed by a periphlebitis throughout the course of the vein. This resulted in some malaise with a slight rise in temperature during the first twenty-four hours. The leg became stiff and painful keeping the patient in bed for two or three days.

After that time there was a rapid improvement and walking was resumed

on the fourth day. The sutures were removed on the eighth day and the patient discharged from hospital as soon after this as was convenient. Four days' sick leave were usually given to allow movements of the leg to become free and full. After the completion of sick leave, the patient returned to his unit for full duty.

The final results of these cases were extremely satisfactory. A continuous and firm thrombosis from thigh to calf was achieved. Three cases with ulceration showed immediate and remarkable improvement. Occasionally there was some residual swelling of the lower part of the leg for a week or ten days. This was controlled by bandaging. Many of the cases treated would have responded imperfectly, if at all, to the ordinary injection therapy.

The treatment of varicose veins takes a certain time, during which the soldier is not able to perform his duty. Comparison of the amount of lost time due to simple injection therapy and to injection and ligation therapy shows a very favourable balance for the latter. A patient who is undergoing a course of injections will need at least twelve attendances if the condition is at all severe. This means that the patient will be off duty for the day of injection and on light duty the following day; a total of twelve days lost and twelve days light duty. This is a conservative estimate.

Transport will have to be arranged to and from the place of injection. The routine described above needs on the average eight days in hospital and four days sick leave; a total of twelve days off duty. Transport need only be provided to the hospital on admission, and from the hospital on discharge. This curtailing of many visits is an obvious saving of time, work and money.

SUMMARY.

The routine of the treatment by ligation and injection of moderate and severe cases of varicose veins is described.

It is claimed that the results obtained are better therapeutically and economically than those obtained by simple injection.

THE OXYGEN ABSORPTION OF VARIOUS ORGANIC SUBSTANCES FROM PERMANGANATE AND FROM HYPOCHLORITE.

BY MAJOR G. V. JAMES,
Royal Army Medical Corps.

BUYDENS [1] reported that animal and vegetable organic matter in water could be differentiated by the differences in their oxygen absorption from permanganate and from hypochlorite. Dixon and Jenkins [2] modified the strength of the permanganate used from N 10 to N 80, the strength used in water analysis and as a result of experiment these authors considered

that the method would be of particular value when passing an opinion on waters of doubtful quality.

In the field, a quick and reliable test of this nature would be extremely useful and the following work was done to examine the process and if possible to determine what compounds were present when the test gave the high values indicative of animal pollution.

The actual detail of the method used in the subsequent work is as follows and only differs in one or two minor particulars from the published methods. These modifications are considered necessary for field conditions where speed is essential and it may prove difficult to obtain the naphtho-flavone used as an indicator by other authors.

Permanganate Figure.—Ten millilitres N/10 potassium permanganate solution and 5 millilitres 25 per cent sulphuric acid are added to 100 millilitres of the water in a 500 millilitres conical flask. The mixture is heated to boiling in five minutes and the boiling continued for another ten minutes. After cooling, potassium iodide is added and the liquid titrated with N/40 thiosulphate solution using starch as an indicator.

Hypochlorite Figure.—Ten millilitres N/10 sodium thiosulphate are added to 100 millilitres of the water in a 500 millilitres conical flask, the mixture heated to boiling in five minutes and boiling continued for ten minutes. After cooling, potassium iodide is added and 10 millilitres 25 per cent hydrochloric acid, the liquid being then titrated with N/40 thiosulphate solution using starch as an indicator.

Blanks.—These are obtained by treating 100 millilitres of distilled water with permanganate and hypochlorite as above.

Calculation.—The ratio of the oxygen absorption from hypochlorite and permanganate is easy to obtain as the same strength of thiosulphate is used for each titration and so after deducting the burette reading for the experiment from that obtained for the blank, it is simply a matter of dividing the hypochlorite reading by the permanganate reading, e.g. :

Hypochlorite " blank "	...	...	35.8 ml.
" expt.	...	...	12.6 ml.
" absorption	...	...	23.2 ml.
Permanganate " blank "	...	...	39.7 ml.
" expt.	...	...	24.1 ml.
" absorption	...	...	15.6 ml.
Ratio, 23.2/15.6 or 1.49.			

Preliminary experiments showed the effect of pH on the hypochlorite figure since a strongly acid water may give an unduly high result by loss of chlorine.

Most waters have a pH range of 5.5 to 8.0 and addition of the hypochlorite will produce a pH of 7.5 to 9.0 which the following results show to be satisfactory, but if the pH is less then adjustment should be made by the addition of alkali. Table I gives the results of the hypochlorite absorption of a 0.2 per cent urine solution (four hours oxygen absorption at 28 C. was 0.38 p.p. 100,000).

TABLE I.

pH	10 mins. hypochlorite absorption				
3.0	0.968 p.p. 100,000.
4.0	0.990 "
6.0	0.735 "
7.0	0.645 "
8.0	0.624 "
9.0	0.622 "

Table II gives the results of oxygen absorption of infusions prepared by soaking various substances in water and filtering, then diluting the liquid to give a solution whose oxygen absorption was approximately 0.25 to 0.30 p.p. 100,000.

The meat and bran solutions were prepared by soaking in warm dilute saline. The meat was cooked and minced before extraction in order that there should be few extractives present and the solution be that of a typical animal protein. In this table, iron salts are included as they also occur naturally in some waters and possess an oxygen absorption.

TABLE II.

Substance	Ratio					Average
Beech leaves	3.36	3.36
Tea	1.7, 1.83	1.76
Laurel	3.57	3.57
Mixed	0.7, 0.3	0.5
Bran	2.2	2.2
average for vegetable substances, 2.28.						
0.1 per cent ferrous sulphate	0.18	
0.1 per cent ferric sulphate	0.19	
Meat extract	3.45	3.45
Bovril	2.87, 1.38	2.12
Peptone	3.34, 1.22	2.28
average for animal substances, 2.65.						
Urine	9.2, 7.7, 9.6	8.8
Fæces	2.7	2.7
Partially digested fæces	4.9	4.9
average for excremental substances, 5.5.						
Urea solution (0.1 per cent)	10.5, 11.3, 18.4	13.4
Ammonium carbonate (0.1 per cent)	9.3, 7.1	8.2
Ammonium chloride (0.1 per cent)	7.7, 5.9	6.8
average for dissolved substances, 9.5.						

The method was applied to various mixtures of urine and leaves and also fæces and leaves with the results seen in Table III.

TABLE III.

Mixture	Ratio				
Leaves 1 : Fæces 1	1.9
" 5 " 1	2.1
" 5 " 2	2.4
" 1 " 1	3.8
" 1 : Urine 1	2.5
" 10 " 1	3.6
" 5 " 1	4.1
" 1 " 1	6.3

DISCUSSION.

Consideration of the results in Table II leads to the conclusion that animal and vegetable material alike give low ratios and the ratio is not specific for the presence of vegetable matter but it does detect the presence

of products of metabolism of the organism as a higher ratio than occurs as shown by the value for urine, urea and the ammonium salts. The method may fail with avian pollution as urea is not then the end product, whilst on the other hand gasworks effluents would give a high value on account of the contained ammonium salts.

The value of the ratio is shown in the case of the following stagnant pond water in which the free and saline ammonia was 0.004 p.p. 100,000 whilst the albuminoid ammonia was 0.161 p.p. 100,000. These figures, taken in conjunction with the oxygen absorption of 0.496 p.p. 100,000 would certainly point to vegetable pollution, but the time taken to arrive at this result would be several hours. The ratio of 1.97 took about thirty minutes and could easily be confirmed by a more prolonged examination if necessary.

CONCLUSIONS.

The ratio of the oxygen absorbed from hypochlorite to that absorbed from permanganate has been investigated for several substances and the enhanced value is considered to be indicative of animal pollution and is ascribed to metabolism products. The average values obtained for true vegetable substances was 2.28, animal substances 2.65, urine and faeces 5.5 and urine constituents 9.5. On account of the enhanced ratios it is possible to detect admixture of urine with infusion of leaves (Table III) and to a lesser extent the presence of faeces.

REFERENCES.

- [1] BUYDENS, R. *Journ. Pharm. Belg.*, 1935, **17**, 359, through Water Pollution Research Abstracts, 1936, **9**, 51, para. 193.
- [2] DIXON, F., and JENKINS, D. C., *Analyst*, 1939, **64**, 735.

A CASE OF TRANSMESENTERIC HERNIA.

BY CAPTAIN DAVID WRIGHT,

Royal Army Medical Corps.

ON November 7, 1940, I was asked to see a case of acute intestinal obstruction. The patient was a Hindu aged about 25, who gave a history of abdominal pain and vomiting of four days' duration. His abdomen was markedly distended and his general condition very poor. The abdomen was opened under spinal anaesthesia (nitrous oxide and oxygen were not available) and was seen to be filled with coils of enormously dilated small intestine. Suspecting an ileocaecal lesion I explored the right iliac fossa but failed to find the caecum there. Further search revealed the caecum lying close to the descending part of the duodenum, quite collapsed and with an inch of collapsed ileum running to it from a small opening in the root of the mesentery. The complete small bowel had passed through this opening with the exception of one inch of ileum and about three inches of jejunum. By a combination of gentle traction of the distal ileum and milk-

ing of the distended small bowel the herniated gut was ultimately withdrawn through the aperture. About a foot from the duodenum there was a diverticulum on the antimesenteric border of the bowel. This diverticulum was slightly less in diameter than the bowel and was just under an inch in depth. The hiatus in the mesentery was closed with a catgut stitch and the abdomen quickly sutured. The patient died twelve hours later. Unfortunately the relatives would not permit a necropsy.

In contrast to external abdominal hernia, internal hernia is one of the rarest of abdominal lesions (Thomson and Miles [1]).

These internal herniæ usually occur in the vicinity of the duodeno-jejunal junction starting, according to Moynihan [2], in the fossæ of Waldeyer and Landzert. They possess a sac as does a hernia through the Foramen of Winslow. Occasionally, however, hernia occurs through an opening in the mesentery and does not possess a sac. These openings are usually idiopathic, but might be due to a tear or to neglect in closing openings thoroughly during short-circuit or resection operations.

In the majority of cases these internal hernia are only discovered following strangulation and obstruction, but they might previously have given rise to symptoms of indigestion, bowel upset and colic. There may sometimes be a palpable globular tumour which is resonant on percussion and yields intestinal sounds on auscultation. Pressure on the inferior mesenteric vein may cause bleeding piles. Alexander [3] has described the radiological diagnosis of the condition and claims that it is less uncommon than has been believed as only a certain number go on to strangulation.

Writing in 1937 Iagnov and Timus [4] collected a series of 55 cases of transmesenteric hernia, of which only 14 occurred subsequent to 1907, so the condition appears to be sufficiently uncommon to warrant the recording of the present case. They state that of these 55 cases, 48 were congenital, 5 were traumatic and 2 gave a history of an inflammatory process in the mesentery causing atrophy secondary to thrombosis. The congenital type is probably due to failure of fixation of the mesentery to the posterior abdominal wall following embryological rotation.

The present case appears to be of the congenital type. The presence of the diverticulum is interesting and, in my opinion, is due to the hernia having been originally of the Richter type, the complete small bowel having passed through the opening at a later date. This was probably due to increased peristaltic action following incarceration of the diverticulum.

REFERENCES.

- [1] THOMSON AND MILES. "Manual of Surgery," 1939, p. 1129.
- [2] MOYNIHAN, B. G. A. "Retroperitoneal Hernia," Arris and Gale Lectures, 1899, London.
- [3] ALEXANDER, F. K. "The Roentgen Diagnosis of Intra-abdominal Hernia," *Am. J. Roentgenol.*, 1937, **38**, 92.
- [4] IAGNOV, Z., and TIMUS, GR. "Les hernies transmésentériques." "Contribution à la pathogénie des brèches du mésentère," *J. de chir.*, 1937, **50**, 203.

Current Literature.

WATS, R. C., and KAMAT, G. K. **The Destruction of Air-borne Bacteria.**
Indian M. Gaz. 1940, v. 75, 212-15, 4 figs.

Pulvertaft and others (*Lancet*, 1939, p. 433), have made extensive tests on the sterilization of air by atomization of bactericidal solutions with a "Phantomyst," an electrically operated apparatus capable of introducing liquid antiseptic into the air in the form of a dry penetrating mist. The antiseptic is in the colloidal state, and is generally termed "aerosol," which remains in suspension for hours.

The object of this work was to test the efficiency of this method to eliminate contamination in the vaccine-making departments of the Haffkine Institute, Bombay.

A room of 5,650 cubic feet capacity was chosen for experiments; the bactericidal solution was a mixture of equal parts of glycerine and saturated aqueous solution of resorcinol; *Micrococcus prodigiosus* was used as the test organism; two types of cloud producing apparatus were used—the phantomyst and an atomizer with a power-driven air compressor outfit as used for humidifying the atmosphere in Bombay cotton mills.

Suspensions of organisms were sprayed into the room and nutrient agar plates exposed before and after working the phantomyst machine. It was found that a minimum quantity of 8 millilitres of the resorcinol solution was required to sterilize the air of the room (about 5,500 cubic feet). In the vaccine-room of 10,000 cubic feet capacity the atomizer was used successfully and 25 millilitres of solution was necessary for sterilization.

It was proved by experiment that the aerosol did not disturb the growth promoting qualities of laboratory media.

The method of sterilization of the air has been introduced into the plague vaccine sowing room and the antirabic department, and has reduced the contamination by over 50 per cent.

E. WINDLE TAYLOR.

Reprinted from "Bulletin of Hygiene," Vol. 15, No. 8.

WILLIAMS, D. H. **Commercialized Prostitution and Venereal-Disease Control.** *Canadian Pub. Health J.* 1940, v. 31, 461-72, 3 figs.

Amongst the many obstacles to the reduction of V.D. in Canada, commercialized prostitution is considered by the author to be very important. Amongst control measures, abolition of brothels ranks high, making sources of infection as inaccessible as possible. The author indicates that the profits of the brothel business are so good as to stimulate powerful opposition to attempts to put into operation the Criminal Code of Canada so far as it relates to this problem.

By law, not only the landlord, or anyone connected with the management of a disorderly house, but a prostitute inmate or a client found on the

premises is liable to prosecution. The trouble is that the law does not seem to have been applied very strenuously, but in Vancouver a determined effort to stop commercialized prostitution was started in February, 1939. Careful examinations of sixty-five known professionals showed that 72 per cent had venereal infections. Many of the infected had certificates provided by practitioners indicating that they were free from disease; this was on the alleged evidence of laboratory tests. The practice of giving such a certificate was condemned by the Canadian Medical Associations, and, with the help of the magistrates' bench and the City Prosecutor, this traffic seems to have been stopped.

Prior to the suppression of disorderly houses, of 358 male patients dealt with at the City of Vancouver Clinic 24·6 per cent stated that they had acquired their infections in brothels. After repression started the percentage fell to 12. The admissions to the clinic showed a fall from 292·5 per month to 193·0. [The author does not discuss the sulphonamide treatment factor in the fall of gonorrhœa cases but mentions a fall of 9·5 to 5 cases of primary and secondary syphilis per month.] The conclusion is that brothels are a potent source of venereal infection and that their suppression, by making prostitution less accessible, is a valuable means of reducing venereal infection.

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

Reviews.

MEDICINE IN A CHANGING WORLD. By David Ockman. M.B., M.R.C.S.
London: William Heinemann (Medical Books), Ltd. 1941. Pp. ix
+ 51. Price 3s. 6d. net.

In this little essay the author gives an account of his views on the causation and prevention of cancer in relation to the humoral theory. The method of presentation is journalistic and it would appear that the subject matter is intended to appeal to the lay reader.

The author defines cancer as "the specific reaction of the body to the saturation of the blood and lymph circulation by a specific auto-synthesized toxic molecule which acts in the circulation as a chronic irritant to all the body cells." It is to be feared, however, that such a definition, even if the truth of it has been proved, does not help much.

These "blood toxins," it is stated, could be removed by judicious venesection and the blood filled up "with endocrine, vitamin, mineral fractions naturally by diet, etc., and with blood transfusions if necessary."

Although there is much that is plausible in what the author has to say the solution of the cancer problem can only be evolved when the cause has been scientifically proved. Much light has been shed on the subject, but

the outlook is still too confused for the formulation of rules to ensure the eradication from the community of neoplastic diseases.

On the frontispiece is a diagram labelled "A view of the organization of living matter" that is rather typical of the book as a whole. The view is presumably the author's; it is not the one that is generally accepted.

On page 19 the name of the early epidemiologist, Fracastoro, is mentioned but the final "o" has been omitted.

H. J. B.

FRACTURES AND OTHER BONE AND JOINT INJURIES. (Second edition.)

By R. Watson-Jones, B.Sc., M.Ch. (Orth.). Liverpool, F.R.C.S.
Edinburgh: E. & S. Livingstone. 1941. Pp. xii + 724. Price 50s.

A large first edition was published in January, 1940, and was sold out months before this edition appeared in January, 1941. The chapter on open and infected fractures and war wounds has been re-written and recent developments, particularly in chemotherapy, blood and plasma infusion, the treatment of war wounds, the closed plaster technique and the technique of amputations, have been included.

It is a strongly and attractively bound volume with a good index and over 1,000 illustrations, mostly photographs but including many diagrams and drawings, a fair proportion being coloured. A device not often seen is effectively employed, viz. covering one of two comparative X-ray films with a flap of paper on which is printed the caption required and the salient points to be brought out.

Many points are stressed which are not generally known among general practitioners or even among non-orthopaedic surgeons, e.g. the delay, in the case of stiff joints with recent adhesions, in regaining function by employing passive stretching; that lack of immobilization of fractured ends is the chief cause of non-union and delayed union; that assessment of union of fractures should be by X-ray films and not by the calendar; that all joints not immobilized, necessarily, in treating the fracture should be moved through their normal range, daily and often, starting from not later than the day after the fracture; the importance of the quadriceps extensor in the stability of the knee-joint, the rapidity with which it atrophies after accident or operation and the necessity of active movements to counteract this; the danger of extension pins causing joint stiffness if inserted through bones in the close vicinity of a joint; that X-rays at right angles must be supplemented by others at other angles in many cases.

The material is well arranged, helpfully dogmatic for the undergraduate and gives a comprehensive survey, based on clinical experience wellnigh unrivalled, making the volume one of the "essential" class of books to the postgraduate in the surgical and general practice spheres and one which will repay surgeon and patient many times over.

J. L. R.

MODERN DIETARY TREATMENT. Second edition. By Margery Abrahams, M.A. (Oxon.), M.Sc. (Columbia University), and Elsie M. Widdowson, B.Sc., Ph.D. (Lond.). London: Baillière, Tindall and Cox. 1940. Pp. xii + 401. Price 10s. 6d.

The science of diets and their practical application is pre-eminently suited to the genius of the Gentle Sex, and one welcomes this latest edition of an already popular manual, written by two ladies obviously with great experience in the subject they treat of.

The authors are lucky in having as advisers such eminent dieticians as Drs. G. Graham, R. D. Lawrence, R. A. McCance, C. Newland and L. Witts, a most imposing hot-pot of talent.

When I was a student, and afterwards, the study and ordering of diets was left almost entirely to the nursing staff, most medical men with the exception of a few so-called cranks and the then small band of children's physicians considering that anything to do with diets or even "faintly smelling of the kitchen" was quite beneath their notice. Now of course this is all changed, and most large hospitals—and many small ones for the matter of that—have as a very integral part of their economy a dietetic department run, in most cases, as it should be, by lady dieticians who have made this difficult branch of medicine their life's study.

In my perusal of the many succulent dishes described, one, I thought, seemed particularly appropriate to the book and the occasion namely "pain perdu" (p. 268); in fact it might well serve as an alternative title to the former.

It reminded me irresistibly and possibly inconsequently of an old couplet:

"What is *bred* in the bone comes out in the flesh."

A fitting epitaph for a good brown stew and a reminder to the housewife that bones should always be saved for the stock-pot.

There can be few branches of human endeavour in which art—the culinary art—and science—the science of dietetics—are more happily wed than in this noble effort to feed the human beast logically and attractively when he is sick.

I can give the book no better recommendation than to advocate its inclusion not only on every physician's shelf but also in every hospital kitchen—Military hospital kitchens please take note.

S. S.

TREATMENT IN GENERAL PRACTICE. SURGERY (Continued). Vol. IV. Articles republished from the *British Medical Journal*. London: H. K. Lewis & Co., Ltd. Pp. xiv + 562. Illustrations 143. Price 16s. net.

This, the fourth of the series, is a volume composed of 55 articles written by 48 eminent contributors.

The scope of the articles is large. Apart from intra-abdominal con-

ditions, which are not included, the subjects discussed form the larger part of military surgical practice.

Of special interest is the series of articles on bone and joint injuries and the after-treatment of fractures. These are comprehensive and contain many of the most recent advances. The treatment of minor or first degree fractures of the ankle-joint by local anæsthesia without immobilization raises the following questions. Firstly, what are the end-results to be? Secondly, will this practice produce a "fit for duty" soldier more quickly than walking plaster fixation?

The sections on infections of the hand and foot, and especially the article on The Treatment of Flat-Foot, will be found most useful.

The publishers are to be congratulated on the production of a most useful volume which will prove an invaluable aid to Military surgeons.

J. A. M.

Correspondence.

A CASE OF HEAT-STROKE.

EXTRACT FROM A LETTER OF AN OFFICER PROCEEDING OVERSEAS.

June 20.—Almost there. To-day is bright and the sun is hot but the heat is less intense and much less oppressive than has been the case for some days past. The climax was reached two days ago. The temperature in the cabin was only 97° F. but the humidity was very high and we were all in a constant bath of sweat.

I had a grand day yesterday. I was asked to see an urgent case at 7 a.m. It was a man of 20 who was admitted to hospital the night before complaining of nausea, vomiting, constipation and lack of energy. He was not regarded as being seriously ill; though his temperature was said to be 101° this was attributed partly to the heat. At about 6 a.m. the following day he was found unconscious by an orderly. When I saw him he was in deep coma, responding but slightly to painful stimuli. corneal reflexes absent, pupils moderately dilated and very sluggish to light, breathing somewhat stertorous and rapid, pulse not palpable, not even the carotid. Heart sounds were not heard (since breathing was noisy I may have missed feeble sounds), skin was cool, rather clammy but no beads of sweat to be seen, and restless, purposeless movements. I was told that the temperature was 102° taken in the axilla. He seemed to me to be about to die. However, I took the temperature in the rectum and found it to be 108°. This simplified the diagnosis so we got to work without delay, first half covering him with broken ice as he lay in bed, then putting up an intravenous saline. The great saphenous vein when exposed was quite empty and did not bleed even a single drop from either end. This took

half an hour, at which time the temperature was still 108° and there was no change clinically. Two pints of normal saline were run in in fifteen minutes during which time he was lying in a pool of ice water in the bed. The rectal temperature was then 104.8° , the radial pulse had returned, restlessness was much less, and his colour was better. Curiously enough the skin of the face, which was growing pink, was now warm—presumably owing to the restoration of the peripheral circulation.

As the temperature was falling more than a degree in five minutes I then lifted him out of the ice and water and placed him in a dry bed, slowing down the saline. During the next half-hour the rectal temperature fell to just under 100° and the pulse improved in volume, the rate being about 100. His state of consciousness improved and he would obey simple commands and answer simple questions with "yes" and "no." I should have said that before improvement began he vomited large amounts of dilute coffee grounds effortlessly—in all about $1\frac{1}{2}$ pints. He took a few sips of water, indicating by nodding that he was thirsty, but he would only take a few sips and did not swallow cleanly.

During the next few hours, up to midday, he deteriorated a little, the temperature rising again to 103° and the pulse to 116, while he failed to respond to questions and refused to attempt to drink. I was then able to get him into an air-conditioned room at a constant temperature of 70° . The intravenous saline was kept running.

There was little change by 9.30 p.m. He did not speak and would not drink. Temperature was 102° , pulse 100, normal saline 7 pints. The patient had not passed urine, bladder was just palpable, colour good, pulse strong.

At 4.30 a.m. to-day I saw him again. There was a dramatic improvement. He spoke rationally and gave a clear history of the past week. Temperature was 97.5° , pulse 90. He was drinking fairly well, but with slight nausea and headache.

Now at 10 a.m. improvement is maintained and I can see no reason why he should not make a rapid and full recovery. When I first saw him I was sure that he could not recover. He was very close to death. This experience reconciles one to the tedium of the voyage. It would have been valuable and interesting to have had information of the blood chemistry and the hæmoglobin concentration. But the case was particularly fascinating because it afforded the opportunity to combine clinical judgment with physiological principles. Once the diagnosis was made the case resolved itself into a laboratory experiment in dehydration and hyperthermia. All one had to do was to reverse the processes that had led to the illness and trust that the central nervous system had not been irrevocably damaged.

P. B. A.

EMERGENCY TRANSPORT OF THE SICK—THE BERRIDGE APPARATUS.

TO THE EDITOR OF THE "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS."

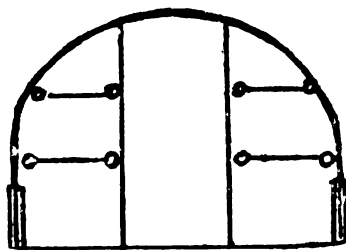
SIR,—The principle of the Berridge Apparatus for adapting lorries to carry stretcher cases is similar to that described by Lieutenant-Colonel Crockford, *M.C.*, in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS* of August, 1941.

It has the added advantage of being fixed to the floor as well as of being detachable and packed in a haversack when not in use.

It was part of the equipment of all lorries in Waziristan and I understand was used during operations in Burma. A full description was given in the *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS* of May, 1931.

Briefly it consists of a set of strong webbing straps fitted with strong hooks and eyes which are fixed to the raves in the roof and sides of the lorry and to the floor, where countersunk eyes are fitted. Loops for the reception of stretcher handles are incorporated in the appropriate positions.

The rough sketch below shows the apparatus fitted.



Although it does not replace a Motor Ambulance, it forms a valuable substitute when an Ambulance is not available as well as a welcome addition to the stretcher-carrying transport of a Field Ambulance.

I tried it out in Waziristan and found that patients could be evacuated in comfort.

Yours, etc.,

D. AHERN,

Colonel,

A.D.M.S. North Wales Area.

Notice.

"ELASTOPLAST TECHNIQUE IN CHIROPODY PRACTICE."

T. J. SMITH AND NEPHEW, LTD., Neptune Street, Hull, have sent us a copy of the new edition of their booklet which describes the general principles of Elastoplast treatment in Chiropody, and we are informed that a copy of the booklet will be forwarded free, on request.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal
of the
Royal Army Medical Corps.

Original Communications.

SOME ASPECTS OF WOUND SHOCK WITH EXPERIENCES IN
TREATMENT.

BY CAPTAIN W. d'A. MAYCOCK, M.D., MCGILL,
Royal Army Medical Corps,

AND

COLONEL L. E. H. WHITBY, C.V.O., M.C., M.D.CAMB., F.R.C.P.
(Army Blood Transfusion Service).

THE proper treatment of any bodily disorder is necessarily based upon an understanding of the fundamental changes responsible. From the clinical aspect the diagnosis of the disorder is made by correlating signs and symptoms. Many of these signs may be common to different pathological conditions and it is only when one or more are pathognomonic that a diagnosis can be made by rule of thumb. Most other states demand judgment and experience whilst some require elaborate supplementary scientific investigations. There can be no better example of these generalizations than the variety of conditions which give rise to the signs and symptoms found in what is conveniently called "shock." Shock is a broad term which describes that state in a person exhibiting lowered vitality and circulatory disturbances following upon mental or bodily injury, including the deliberate procedures of a surgical operation. The state may range from a mere faint, which quickly passes, to gross circulatory failure which cannot be recovered from. The classical symptoms and signs are a lowered blood-pressure, a pulse which is usually fast and of poor volume, pallor and or cyanosis, especially of the lips and nails, sweating and coldness. In cases of injury the mental state is often surprisingly clear and alert, whilst

pain may be very little in proportion to the amount of tissue damage. Vomiting is common. When the blood-pressure is persistently low, later signs include reduction in urinary output followed by anuria. This battery of symptoms, sometimes trivial, sometimes serious, obviously needs to be carefully analysed in relation to cause, if proper treatment is to be prescribed. Too often the condition of "shock" is accepted as a single clinical entity and the treatment given is as vague and unscientific as the diagnosis.

War has brought the whole subject of shock very much to the fore and there has been much experience to assess and expand the valuable observations made in the war of 1914-1918. There has been opportunity to study the reactions of the human body to various combinations of injury, fear, exposure, hæmorrhage, burns, crushing, multiple fractures, head wounds and other features such as delay between injury and treatment. These observations, made on an unrestricted age group, for casualties now include the very old and the very young and not simply the fit young Service man, need to be carefully classified into groups in order that the clinician may be presented with descriptions sufficiently clear to enable him to visualize the fundamental cause of the symptoms in each individual case. New causes of circulatory collapse in the injured as well as factors which may modify the clinical picture will doubtless be discovered when the experimental and clinical work of the war is analysed and correlated. In the meanwhile the following description gives some of the known causes of circulatory collapse in the injured. The voluminous literature of the subject is briefly reviewed later.

CAUSES OF CIRCULATORY COLLAPSE IN THE INJURED.

(A) *Blood-Volume Reduction.*

This is undoubtedly the commonest cause of circulatory collapse following upon injury and is the the group in which transfusion of the appropriate fluid is usually effective. For this reason transfusion may be regarded as the most important single measure for resuscitation work. Reduction in blood-volume causes circulatory embarrassment because cardiac filling is imperfect. Consequently cardiac output, as well as the efficiency of the driving force, are greatly reduced. This leads to imperfect nutrition, particularly of the peripheral parts, and is a progressive state in which metabolism falls to a low ebb and vital tissues finally become damaged beyond recovery. Thus, in the later phases of blood-volume reduction, the peripheral capillaries may become permeable so that plasma leaks from the circulation into the tissue spaces.

Blood-volume reduction may arise in a number of ways ; the immediate or the final effects differ according to the manner in which the reduction is brought about.

(1) *Hæmorrhage.*—Frank hæmorrhage means a loss of all elements of the blood. In healthy people an acute loss not exceeding a pint is immaterial

but a loss of two pints or more is a geometrically progressive embarrassment to the circulation. Nevertheless it has been found that life can still continue for a few hours even when as much as six or seven pints are lost. And provided that adequate replacement can be made without delay many lives can be saved. The physiological reactions following upon hæmorrhage are firstly a compensatory vasoconstriction in an effort to maintain a reasonable blood-pressure and to make the best use of what blood remains, and, secondly, the absorption of fluid from the tissues in an attempt to restore blood-volume. This restoration is a more vital and urgent requirement than the making up of lost hæmoglobin. The symptoms of shock disappear in those who survive the hæmorrhage sufficiently long for blood-volume to be efficiently restored. The same occurs in those whose blood-volume is restored by transfusion. But those whose blood-volume remains reduced and whose circulation therefore continues to operate in an embarrassed manner progress to the stage of irreversible capillary damage and they begin once again to lose circulatory fluid (plasma), this time into the tissue spaces. In these, the blood becomes concentrated and this increased viscosity adds to the difficulties of the heart. Such states arise under the conditions of delayed evacuation found in battle rather than in air raid casualties who usually reach hospital within a short time of wounding.

(2) *Plasma Loss.*—(a) *At Site of Injury.*—Whenever there is tissue injury there is an exudation into the injured area. This can be observed in an injured limb when a tourniquet is removed and is shown by a rapid swelling of the tissues in the injured area quite apart from hæmorrhage itself. And so the blood lost in an acute hæmorrhage may not represent the whole of the fluid lost to the circulation; long after the hæmorrhage has ceased plasma exudation into the wounded area may continue. Plasma exudation is a serious aspect of blood-volume reduction because of the increase in blood viscosity.

(b) *Crush Injuries.*—Considerable plasma loss from the circulation occurs when any part of the body is compressed or crushed for long periods. This happens even though there is no rupture of blood-vessels or severe tissue-damage such as a fracture. The exact mechanism of this phenomenon, which is a progressive œdema into the crushed tissues accompanied by the formation of skin blisters, is not completely understood. The plasma loss may be great enough to cause a vast reduction of blood-volume. The early phases may therefore be associated with a falling blood-pressure and other symptoms of shock though, in the late phases and sometimes in the early ones, there may be a rising blood-pressure which may possibly be a symptom of developing or established renal incompetence.

(c) *Burns.*—There is always an exudation of plasma into a burned area and this lesion provides the purest example of blood-volume reduction due entirely to plasma loss. The amount lost may be very large and so cause a gross increase in blood-viscosity from hæmoconcentration. There appear

also to be other factors, tentatively suggested to be toxic substances derived from the destroyed tissue, which contribute greatly to the symptoms of circulatory collapse and which may not come into operation until a day or two after receiving the burn.

(d) *Gross Dehydration*.—Body water is maintained at a constant level by a balance between fluid intake and output. Should intake cease, output nevertheless continues. The process in a person dying of thirst is that he first excretes tissue fluid and when this source is exhausted he begins to lose fluid even from the circulation itself. The last stages of dehydration therefore give rise to blood-volume reduction accompanied by hæmoconcentration which produces symptoms of circulatory collapse. It will be appreciated that under battle conditions severe grades of dehydration may occur. Men are often potentially dehydrated before they are even wounded. They may be in places where water is difficult to obtain whilst exertion and sweating increase the fluid loss. When wounded, the reaction to blood loss is to absorb tissue fluid into the circulation. And if no fluid by mouth is available advanced degrees of dehydration may occur, becoming more and more pronounced the longer the delay between wounding and receiving treatment. It is for this reason that the giving of fluid by mouth is such an important part of the treatment of battle casualties. Not only does such fluid overcome dehydration but also helps the patient to restore his own blood-volume efficiently and quickly.

(B) *Psychogenic and Neurogenic*.

Emotion, fear and pain are known to influence cardiac action and to produce fainting or syncope, brief or prolonged. The patient may exhibit alarming signs of cardiac embarrassment including a low blood-pressure and the peripheral signs of sweating, pallor, cyanosis and coldness. This may occur with or without definite bodily injury. The state, in its pure form, usually responds to conservative measures which include relief of pain, reassurance, warming up and the administration of hot stimulating drinks; when it occurs in combination with definite injury the amount of collapse due to nervous influence cannot be assessed in advance; it is only revealed when conservative treatment alone produces an obvious improvement in condition. No casualty, in whom the nature of the wounds is such that he obviously falls into the first category (blood-volume reduction), should be treated for prolonged periods with conservative measures only in the hope of achieving a result. It is therefore important to examine all patients thoroughly in order to be aware of the nature and extent of the injuries before attributing their symptoms to neurogenic causes alone.

(C) *Toxæmia*.

During the war 1914–1918, it was found that casualties admitted with an established gas gangrene infection often exhibited circulatory embarrass-

ment or collapse. The removal of an infected limb would sometimes cause such symptoms to disappear. This again is a feature more commonly found in battle casualties than in those quickly evacuated from an air raid. The surgical treatment of infected cases should not therefore be delayed longer than possible.

(D) *Fat Embolism.*

This phenomenon which has been rediscovered as the result of the many bony injuries of total war is associated with general collapse, apathetic, delirious or comatose mental state and sweating. Unlike the conditions described above, the blood-pressure is usually well maintained. But unless this important observation is made the clinical state is not readily differentiated from that of other causes of collapse. The importance of bearing fat embolism in mind is that it is usually made worse by transfusion.

FACTORS WHICH MAY CONTRIBUTE TO CIRCULATORY COLLAPSE
IN THE INJURED.

It may be accepted that blood-volume reduction, whether from blood loss or plasma loss or both, is by far the commonest cause of progressive circulatory embarrassment in the injured.

Nevertheless there are a number of factors, briefly summarized below, which are known to have or thought to have a bearing on the problem of shock. Some of these operate as part of the vicious circle of progressive circulatory collapse whereas others are believed to come into play in special types of injury.

Anoxia.—One of the symptoms of an embarrassed circulation is cyanosis and anoxia may therefore be regarded as part of the vicious circle of events that finally leads to death. Though anoxia does not cause shock, its relief may considerably assist recovery. It is known also that an unskilfully-administered anæsthetic may rapidly cause circulatory collapse. There is no special virtue in gas and oxygen anæsthetic unless it is skillfully given.

Pain.—This factor undoubtedly contributes to circulatory collapse and continuous bombardment of the nervous system by nociceptive impulses is regarded by some as one of the fundamental factors in producing a state of shock. In practice the prevention of the pain factor is accomplished by the administration of morphia and occasionally by judicious local anæsthesia. A spinal anæsthetic is considered to be dangerous.

Cold.—Continuous exposure to cold has long been recognized as a contributory factor. Hence the importance of facilities for warming patients. At the same time overheating is deleterious and must be avoided.

Adrenal Factors.—Certain experimental results indicate that adrenal cortical-extracts may be useful in the treatment of shock but the evidence is by no means convincing and in the present state of knowledge the administration of these extracts must be regarded as purely experimental.

RECEPTION OF CASUALTIES.

Experience on active service and at home has shown the importance of resuscitation work and made it quite clear that the work needs to be carried out as a separate department with its own premises, specially allotted, and highly-trained staff, and with its own equipment as distinct from that of the rest of the hospital. The senior medical officer should be a physician of experience with junior officers adept at transfusion and nurses or orderlies familiar with all the simple apparatus used. All the staff should be thoroughly drilled in procedure including work under adverse conditions of emergency heating or lighting. Apparatus is required for the giving of transfusions, together with an adequate stock of blood, plasma or serum, and saline, as well as stands for the suspension of the transfusion bottles, simple surgical instruments for cutting down and inserting a cannula, facilities for administering oxygen, arresting hæmorrhage, making warm drinks, warming blankets, and drugs for the relief of pain and treatment of collapse. There needs to be a plentiful supply of cuffs for a blood-pressure apparatus so that a cuff can be left in position on a patient for several observations without disturbance. If these are provided one recording instrument will serve for many beds.

On reception, all cases, except chest or head injuries, should be placed in the head low position between blankets already warmed and the clothes be removed with scissors. Common sense will dictate whether a case is better left on a stretcher for a time or whether an immediate move into bed is justifiable. In the former case the stretcher should be placed on the bed. Manipulation, movement and disturbance must be reduced to a minimum.

ASSESSMENT.

The first requirement is to make a clinical estimate of the state of the patient and to sort out, as far as possible, those who fall into the neurogenic and psychogenic class, with little or no bodily injury, from those who, from the nature of their wounds, have obviously suffered a definite reduction in blood-volume either from blood loss or plasma loss. One has to consider the possibility of complicating factors such as dehydration, toxæmia or fat embolism, and to judge whether anoxia or other symptoms are contributing to the distressed state. Having made these estimations, reasonable treatment can be prescribed. For making this assessment it has been found that the amount of sweating, coldness or pain is not a reliable quantitative guide to the severity of the case, whilst the mental state may be definitely misleading. Those at the point of death may be acutely alert and rational. The pulse-rate too has not always been found to increase in proportion to the severity of the state and, though it may be accepted that the more severe cases have usually a rapid pulse, this feature may be entirely misleading especially if divorced from the blood-pressure reading. The volume of the pulse is more reliable than the rate. Pallor is of importance. It not only suggests blood loss but in rapidly evacuated cases gives some idea of

the amount of compensatory vasoconstriction in response to blood-volume loss, which compensation in some cases, especially the young, may be sufficient to maintain a reasonable blood-pressure.

The blood-pressure itself, not so much a single reading as serial ones at ten to fifteen minute intervals, may be regarded as the one really reliable measurable clinical observation for making a reasonable quantitative assessment. A low blood-pressure or a blood-pressure which continues to fall despite conservative treatment is always a serious sign. A relatively high blood-pressure is not always a favourable one; the observation needs to be correlated with the nature and extent of the injuries. If the blood-pressure appears to be unexpectedly high, in relation to the probable amount of blood lost, some of the optimistic reading needs to be discounted. Unexpectedly high blood-pressure may be found in hypertensive subjects and in young subjects still in the stage of reasonably efficient compensatory vasoconstriction. If neglected or treated merely with conservative measures sudden collapse is usual.

It is therefore very essential to have full knowledge of the nature and extent of the injuries in order that these may be correlated with the other clinical observations and enter into the complete estimate. This knowledge must be obtained with the minimum of disturbance and manipulation. One of the most important items of equipment is a large pair of carpet-fitter's scissors with which clothes can be ruthlessly and completely removed without disturbance.

TREATMENT.

Relief of pain with morphia, warming with hot blankets and bottles or cradles, administration of fluid by mouth, preferably warm drinks such as hot coffee, all of which can with advantage contain a pinch of salt, should be a routine, with the exception of abdominal wounds from whom fluids should be withheld.

Sympathy and encouragement to all patients is important. All who are judged to have suffered significant blood-volume reduction, whether this be shown by low blood-pressure or by common-sense deduction from the nature of the wounds, should be transfused without delay. Transfusion raises such questions as choice of fluid, amount to be transfused and the rate at which it is to be given.

Choice of Fluid for Transfusions.—On first principles those who have lost blood require blood, those who have lost plasma require plasma and those who are dehydrated require saline. But treatment is greatly influenced by the supplies available. Blood, being a perishable fluid, is not always ready in large amount at the right time and in the right place, whereas stocks of durable protein-containing transfusion fluids—plasma or serum in fluid or dried form—can be accumulated anywhere without waste. Furthermore the primary object of the transfusion is to restore blood-volume with a fluid which will remain in the circulation and this is far more

vital than the restoration of the lost oxygen carrying power. Plasma or serum is therefore suitable, in the absence of blood, for the restoration of blood-volume due to frank hæmorrhage, but it is an advantage, when the transfusion needs to be large, if blood is available, for at least one pint in three to be blood, so that some part of the oxygen carrying power can be restored. On the other hand when blood-volume reduction is due to plasma loss it is physiological to replace with plasma, whereas blood, in that the corpuscular content adds to the viscosity of the circulating fluid, is contra-indicated. Saline or glucose being non-protein fluids, are not suitable for blood-volume restoration in that the effect lasts only for the short time which the fluid is retained in the circulation. Furthermore if given in large amount they produce pulmonary œdema. Administration of saline or glucose-saline should be restricted entirely to those judged to be suffering from dehydration, as shown by dry mouth, scanty urine, desiccated appearance, long delay between wounding and reception. In these the effect of saline is remarkably beneficial. Every pint of saline should be alternated or mixed with a pint of 5 per cent glucose.

Amount to Transfuse.—The object of the transfusion is to make an approximately quantitative replacement of the protein fluid lost and the amount should theoretically be controlled by a blood-volume determination. Cases which have been especially investigated from this scientific aspect (Kekwick, Maycock, Marriott and Whitby, 1941) have shown that a reasonable clinical guide to the sufficiency of a transfusion is the effect on the blood-pressure and that a rise of 10 to 20 mm. Hg can be anticipated for every pint transfused. When the anticipated rise does not occur continued or renewed bleeding should be suspected. It can therefore be estimated that a casualty with an initial blood-pressure of 50 mm. Hg will probably require three or four pints to restore the blood-pressure to a point sufficiently high to enable him to withstand operation. It may be assumed also that any wounded person whose blood-pressure is persistently below 100 mm. Hg will never be harmed by the administration of one or two pints.

Rate of Transfusion.—Transfusion in the injured can be practised at a much greater speed than is usual in ordinary medical practice, for it may be assumed that prior to wounding the heart muscle was in a healthy condition and that the rational procedure is to replace the acute blood loss as quickly as possible. The early stages of a transfusion may therefore be conducted at the rate of a pint in ten minutes until the blood-pressure is in the region of 90 to 100 mm. Hg, when the rate should be halved or quartered and afterwards adjusted according to progress. In some patients, however, a fast rate is not well tolerated and this may be shown by the occurrence of rigors. In such cases a slowing of the rate is almost instantly effective.

Maintenance of Condition.—Resuscitation does not necessarily end in the ward. A patient may deteriorate rapidly as the result of delay or in the operating theatre itself because of the movement on to the table, the anæsthetic, further loss of blood or the surgical procedure itself. It is as well

therefore for the last bottle set up in the ward to be administered at slow drip rate so that this accompanies the patient to the theatre and be speeded up should there be any falling off in the general condition.

Oxygen Administration.—Cyanosed patients are made more comfortable by the administration of oxygen which is especially useful in cases of chest wounds. The administration needs to be in high concentration and for practical purposes the B.L.B. mask is the only really efficient apparatus. Oxygen should be regarded as an adjunct for use in selected cases.

EXPERIMENT ASPECT.

The foregoing straightforward opinions and recommendations are based on a vast amount of experimental work and a more limited number of clinical observations on the human subject. The following is a very brief critical review of some of the more important work.

Blood-Volume Reduction.—Keith (1919) during his studies on the wounded in the last war conclusively demonstrated that diminution of the circulating blood volume was the cardinal pathological change in those exhibiting the symptoms of shock ; his observations have been confirmed experimentally by many workers.

Gasser, Erlanger and Meek (1919) state that the blood-volume is diminished in animals, no matter what method is used to produce shock.

The most obvious cause of a lowered blood-volume is *hæmorrhage*, either external or internal. But a diminished blood-volume is found also in cases of severe shock in which blood loss has not been large enough to explain the state of the patient. *Hæmorrhagic shock* and shock without great loss of blood are in many ways similar and the effect of even slight *hæmorrhage* in increasing the state of shock emphasizes the relationship between the reduction of blood-volume by *hæmorrhage* alone and reduction by some other condition (Roome, Keith and Phemister, 1933). Shock and *hæmorrhage* have been differentiated by the observations that in the former *hæmoconcentration* is a feature and in the latter dilution occurs (Moon and Kennedy, 1932). It has also been argued that in shock there is congestion of the visceral blood-vessels, accompanied by *œdema* and *petechial hæmorrhages*, while in *hæmorrhage* autopsy reveals an *anæmic* condition of the tissues. This broad distinction between *hæmorrhagic* and *traumatic shock* is probably unjustified for, experimentally, Parsons and Phemister (1930) produced *traumatic shock* in dogs in which *hæmoconcentration* was rarely observed and Blalock (1934) showed that maintenance of a low-blood-pressure for several hours by continued small *hæmorrhages* caused changes in the tissues resembling those described above as following shock. More recently Dunphy, Gibson and Keeley (1941) have stated that the post-mortem microscopical changes in animals succumbing within a few hours from thermal and mechanical trauma showed no evidence of capillary damage and closely resembled the changes following acute *hæmorrhage* ;

after a longer period (six to twelve hours), however, there was histological evidence of capillary damage and loss of fluid into the viscera. The available evidence suggests that the early morphological findings in shock and hæmorrhage are in some respects similar and that later in both conditions there is damage to the small blood-vessels.

Loss of red blood cells is less important than the diminution of blood-volume in causing the harmful effects of hæmorrhage for Peyton Rous and Wilson (1918) showed that rabbits could be deprived of 75 to 80 per cent of their circulating hæmoglobin without suffering great harm provided the blood-volume was maintained.

To explain the observed diminution of blood-volume in cases of shock, in which hæmorrhage has not been great, is difficult. With few exceptions these cases have all suffered severe injury involving the destruction of relatively large amounts of tissue.

Traumatic Toxæmia.—The general impression given by the work of the M.R.C. Special Shock Committee during the last war was that gross tissue injury, especially of muscle, was attended by the formation, in the damaged tissue, of a toxin or toxins which was washed into the general circulation and caused circulatory collapse. The experimental work of Dale, Laidlaw and Richards on histamine, briefly described in Special Report Series No. 26, 1919, lent strong support to this conception, for injections of sufficient histamine into a cat were shown to cause an arteriolar constriction, loss of tone and abnormal permeability of the capillaries, hæmoconcentration, a diminution in blood-volume and finally death. The blood had passed out of currency and stagnated in the dilated capillary bed; in addition plasma was lost through the capillary walls. It was stressed that histamine poisoning in an anæsthetized animal and shock in a wounded man resembled one another and that this similarity suggested that the phenomena of shock might be due to toxic substances formed in injured tissue. The identity of the two conditions was never claimed.

The experiments of Cannon and Bayliss (Special Reports Series No. 26, 1919) led them to conclude that the collapse of the circulation was caused by poisonous substances formed in the injured tissue. Later workers have failed to demonstrate satisfactorily the presence of any toxic substances. Among them, Dragstedt and Mead (1937) state that they failed to find any vasodepressor toxin in the blood and lymph of dogs during experimental shock. Rose and Browne (1940) pointed out that in patients with shock, the total blood histamine was lower in the severer cases, and suggested that this decrease might be due to fixation of the substance in the gastrointestinal tract or injured tissue. Although there is no evidence satisfactorily demonstrating the presence of toxic substances it cannot be denied that they may play some part in shock.

Fluid Loss at the Site of Injury.—About 1930 much work began to appear in America which tended to show that it was unnecessary to assume that a toxic substance was formed in injured tissue and that much of the experi-

mental work adduced in favour of traumatic toxæmia could not be repeated successfully.

Cannon and Bayliss had shown that if the blood supply to a traumatized limb were occluded, the blood-pressure did not fall and shock did not develop. If the circulation were restored the blood-pressure started at once to decline and shock developed. The same investigators removed the injured limb and compared its weight with that of its intact fellow and concluded that the increase in weight of the injured limb (which was due to extravasated blood and plasma) was insufficient to account for the death of the animal. Cannon and Bayliss also showed that preliminary denervation of the injured limb did not prevent the onset of shock.

Blalock (1930) and Parsons and Phemister (1930) produced shock in dogs by traumatizing one hind limb. They found on comparing the weights of the injured and intact extremities that the increase in weight of the injured leg, which was assumed to be due to loss of blood and plasma from the circulation, amounted in most instances to about half the calculated blood-volume. The method of estimation of weight of the limbs employed by Cannon was criticized on the grounds that it took no account of the swelling in the loose inguinal and retroperitoneal tissues, which was usually found when the thigh was injured. Blalock therefore amputated the hind extremities through mid-abdomen, and then bisected the hind quarters by sawing up the spinal column. Parsons and Phemister, however, excised the limbs by severing symmetrically the tissues attached to the innominate bones. In spite of this difference in technique both found that there was sufficient loss of blood and plasma into the injured part to account for the fall in blood-pressure. No evidence of toxic substances in the blood returning from the injured limb was found. Cannon and Bayliss apparently did not attempt to produce shock in animals after occluding only the venous return from the injured leg. Blalock showed that when such a procedure was carried out, shock could still be produced ; he observed also that on releasing the venous obstruction the slope of the blood-pressure fall became less steep, instead of more precipitate as one would expect if the blood were carrying poisonous substances into the general circulation. Parsons and Phemister state that if the venous drainage of the injured limb is obstructed the shock develops more rapidly and is of a severer degree than when the veins are patent.

Blalock and Parsons and Phemister attempted to demonstrate the presence of toxins in the blood returning from the limb by introducing it in various ways into normal animals and animals whose condition had been weakened by hæmorrhage. The experiments met with no success.

Blalock and his associates in later papers showed that in mild trauma of the extremities sufficient fluid is lost at the site of the injury to explain the lowered blood-pressure and further that this fluid analytically closely resembles plasma. It was also shown by Johnson and Blalock (1931) that the loss of plasma is more deleterious than the loss of whole blood or red blood cells alone.

That local fluid loss plays an outstandingly important part in causing the development of shock is now generally recognized. That it alone is responsible is probably untrue and other factors must be considered. Some of these formerly occupied the position now held by local fluid loss and were considered the prime cause of shock. Now they are regarded as secondary factors of varying importance.

Nervous Factors.—The nervous exhaustion theory of the origin of shock was the leading theory up to the time of the last war, when it was superseded by the theory of traumatic toxæmia. In 1935 new evidence in favour of this theory was produced by O'Shaughnessy and Slome. They first performed experiments to see if they could demonstrate a toxin and failed. They next investigated the amount of fluid loss occurring at the site of injury and concluded that it was insufficient alone to explain the state of shock and that other factors must be considered. They found that they could produce shock by traumatizing a limb which was connected to the body by the nerves alone and which was nourished by an artificial circulation from a second cat. The injured animal died, but the results of the experiment were complicated by the death of the donor cat. They also showed that the elimination of nervous impulses by (1) nerve section, (2) spinal cord section, and (3) spinal anæsthesia, prevented the development of shock. From their results they concluded that local fluid loss and nociceptive nervous impulses are both important ætiological agents. While not attempting to dogmatize on their relative importance, they personally believed that the nociceptive impulses were of greater importance than the local fluid loss. No attempt was made to explain how the nociceptive impulses caused the circulatory collapse. Attempts were soon made to repeat this work. Bell, Clark and Cuthbertson (1938), Blalock and Cressman (1939) failed to obtain the same results. The latter group of workers found that if they used choralose as the anæsthetic, which was used by O'Shaughnessy and Slome, they could obtain evidence showing that nociceptive impulses were of importance but under no other experimental conditions. Louber, Kabat and Welte (1940), however, satisfied themselves that they could reproduce O'Shaughnessy and Slome's experiments.

Adrenal Medulla.—Porter (1907), Seelig and Lyon (1909) all contended that vasoconstriction was a feature of shock and that a peripheral vasodilatation due to collapse of the vasoconstrictor system through exhaustion did not occur save perhaps terminally. Porter was able to show experimentally that the vasomotor centre was active in shock. Recently the role of the adrenal medulla has been re-emphasized, particularly by Freeman (1935). It is well known that the adrenal medulla is activated by pain, cold, anxiety, all states likely to be present in shock. It has been shown experimentally that the infusion of adrenalin in suitable amounts will cause an oligæmia, extrusion of plasma, a low blood-pressure and hæmorrhages in various tissues. The blood-volume has been shown to decrease by as much as 27 per cent. The explanation of the role of the

adrenal medulla is that the sympatho-adrenal activity tends to ensure the blood supply to the vital centres at the expense of a generalized vasoconstriction, especially in the skin and splanchnic area, which causes eventually stasis of blood in the capillaries, increased permeability of the capillary walls and loss of plasma. Cannon (1934) has also pointed out that over-activity of the sympathetic nervous system and excessive secretion of adrenalin may lead to dilatation of the small vessels in muscles and the consequent passage of fluid into the tissue spaces. Normally in active muscle this fluid would pass into the lymphatics but, in the shocked patient, this pumping action of the muscles is lacking. In contrast to this evidence in favour of the possibility of the adrenal medulla being active in shock, Davis (1937) produced shock by hæmorrhage, trauma, and the injection of adrenalin and histamine. He found that the tissue changes produced by adrenalin did not resemble those caused by hæmorrhage or trauma and concluded that they lent no support to the theory that the adrenal medulla was active in shock. Similarly Hamlin and Gregerson (1939) were unable to show in unanæsthetized animals that adrenalin caused a diminution in blood-volume.

While there is evidence for both sides, it seems most probable that the adrenal medulla together with the sympathetic nervous system is active in shock. The importance of this activity is difficult to assess. One should probably regard it as an accompaniment of the shocked state.

Adrenal Cortex.—The similarity between shock produced by mechanical trauma and the condition which follows bilateral adrenalectomy is striking. That there may be a relative deficiency in the elaboration of the cortical hormone in shock has been an attractive theory, since lack of this principle causes amongst other things a hyporolæmia with hæmoconcentration and increased viscosity, increased pulse rate and an increased sensitiveness to hæmorrhage and trauma. Swingle and his collaborators from their work on trauma (of intestines and muscle) in adrenalectomized animals were led to conclude that the capillary atony caused by the lack of cortical hormone increased the permeability of the capillaries and they observed that infusions of saline were ineffective in raising the blood-pressure unless cortical extract was administered simultaneously. They also observed that the cortical hormone itself had a blood-pressure raising effect. Weil and Browne (1940) found that there is an increased excretion of cortin in the urine after surgical operations; this observation may be connected with the earlier findings of Selye (1937) that exposure of animals to various damaging agents is accompanied by a hypertrophy of the adrenal cortex. The changes in the cortex found by Selye occur in a comparatively short time after injury but there do not appear to have been any similar observations in human beings dying of shock. These observations would indicate that one of the body's reactions to an injurious stimulus is an increased activity of the adrenal cortex, and that the need for the cortical principle is in some way increased. However, the finding of an increased urinary excretion of cortin

in human beings would suggest that excess amounts are being produced or that there is a diminished utilization or destruction.

It is difficult to reconcile these findings and to knit them into a satisfactory exposition of the role of the adrenal gland. Certain experimental results, however, indicate that adrenal cortical principles may be useful in the treatment of shock but the evidence is in no way conclusive.

Heuer and Andrus (1934) produced a fall in blood-pressure by injecting aqueous extracts of the contents of loops of bowel which had been obstructed and they observed that the immediate injection of cortical extract prolonged the life of the animal and tended to prevent the fall in blood-pressure and the loss of plasma from the vessels which occurred in the absence of this treatment. Selye and Dosne (1940) produced shock in rats by injuring the thigh muscles and manipulating the intestines. The survival period of the group injected with corticosterone was significantly longer than that of the untreated group. Desoxycorticosterone and extracts of adrenal cortex were ineffective. Selye, Dosne, Bassett and Walker (1940) found that not only was desoxycorticosterone ineffective but actually harmful in the treatment of their animals. Cortical principles have also been claimed to be helpful in the treatment of burns in which the blood sodium is lowered.

It is not possible at present to assess the usefulness of cortical preparations in the treatment of shock or the part played by the adrenal cortex in producing the state of shock. The present evidence would indicate that such preparations may be found to be useful in selected cases.

This short survey of some of the literature is not intended to be a comprehensive review. Its purpose is to touch upon some of the more important aspects of the experimental work on shock and to give an idea of the many-sided character of the condition without undue emphasis upon any single feature.

REFERENCES.

- BELL, J. R., CLARK, A. M., and CUTHBERTSON, D. P. (1938). *Journ. Physiol.*, **92**, 361.
 BLALOCK, A. (1930). *Arch. Surg.*, **20**, 959.
Idem. (1934). *Ibid.*, **29**, 87.
 BLALOCK, A., and CRESSMAN, R. D. (1939). *Surg. Gynec. and Obstet.*, **68**, 278.
 CANNON, W. B. (1934). *Ann. Surg.*, **100**, 704.
 CANNON, W. B., and BAYLISS, W. M. (1919). M.R.C. Spec. Reports Series No. 26.
 DALE, H. H., LAIDLAW, P. P., and RICHARDS, A. N. (1919). M.R.C. Spec. Report Series No. 26.
 DAVIS, H. A. (1937). *Med. Ann. Dist. of Columbia*, **6**, 344.
 DRAGSTEDT, C. A., and MEAD, F. B. (1937). *Journ. Amer. Med. Assoc.*, **108**, 95.
 DUNPHY, J. E., GIBSON, J. G., and KEELEY, J. L. (1941). *Surg. Gynec. and Obstet.*, **72**, 823.
 FREEMAN, N. (1935). *Ann. Surg.*, **101**, 484.
 GASSER, H. S., ERLANGER, J., and MEEK, W. J. (1919). *Amer. Journ. Physiol.*, **49**, 31.
 HAMLIN, E., and GREGERSON, M. I., (1939). *Ibid.*, **125**, 713.
 HEUER, G. J., and ANDRUS, W. (1934). *Ann. Surg.*, **100**, 734.
 JOHNSON, G. S., and BLALOCK, A. (1931). *Arch. Surg.*, **22**, 627.

- KEITH, N. M. (1919). M.R.C. Spec. Reports Series No. 27.
- KEKWICK, A., MAYCOCK, W. D'A., MARRIOTT, H. L., and WHITBY, L. E. H. (1941). *Lancet*, **1**, 99.
- LOUBER, V., KABAT, H., and WELTE, E. J. (1940). *Surg. Gynec. and Obstet.*, **71**, 469.
- MALCOLM, J. D. (1905). *Lancet*, **II**, 573.
- MOON, V. H., and KENNEDY, P. J. (1932). *Arch. Pathol.*, **14**, 360.
- O'SHAUGHNESSY, L. E., and SLOME, D. (1935). *Brit. Journ. Surg.*, **22**, 589.
- PARSONS, E., and PHEMISTER, D. B. (1930). *Surg. Gynec. and Obstet.*, **51**, 196.
- PORTER, W. T. (1907). *Amer. Journ. Physiol.*, **20**, 444.
- ROOME, N. N., KEITH, W. S., PHEMISTER, D. B. (1933). *Surg. Gynec. and Obstet.*, **56**, 161.
- ROSE, B., and BROWNE, J. S. L. (1940). *Proc. Exper. Biol. and Med.*, **44**, 182.
- ROUS, P., and WILSON, G. W. (1918). *Journ. Amer. Med. Assoc.*, **70**, 219.
- SEELIG, M. G., and LYON, E. P. (1909). *Ibid.*, **52**, 45.
- SELYE, H. (1937). "*Endocrinology*," **21**, 169.
- SELYE, H., and DOSNE, C. (1940). *Lancet*, **II**, 71.
- SELYE, H., DOSNE, C., BASSETT, L., and WALKER, J. (1940). *Canad. Med. Assoc. Journ.*, **43**, 1.
- SWINGLE, W. N., PARKINS, W. M., TAYLOR, A. R. and HAYS, H. W. (1938). *Amer. Journ. Physiol.*, **124**, 22.
- WEIL, P., and BROWNE, J. S. L. (1940). *Journ. Clin. Invest.*, **19**, 772.

FURTHER OBSERVATIONS ON SALMONELLA FLAGELLAR ANTIGENS.

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THE suggestion was made in an earlier communication (Archer 1938) that the early, and incorrect, acceptance of certain organisms of the Salmonella Group as monophasic in the group phase was due to the recessive nature of the specific antigen in such organisms. Further, it was suggested, that the more common occurrence of the specific phase of diphasic organisms is due to the fact that it is usually the *group* antigen which is recessive; and finally that the failure of either a "pure" group or a "pure" specific suspension to produce, when used as an antigen, a correspondingly pure group or specific antibody, is due to the presence of organisms in the recessive phase in the inoculum rather than to the presence of both group and specific antigens in any individual bacterial cell.

The object of this further communication is to record later observations which, while affording additional evidence in favour of the theory of the dominant and recessive character of antigens and of the persistence of recessive forms in cultures of the dominant phase, have *also* furnished data which strongly suggest that both group and specific antigens *may* occur in the same bacterial cell (for convenience the term "hybrid" will be used to designate such group-specific organisms) and to discuss, in the light of these observations the morphological basis of group and specific variation.

I.

FLAGELLAR STRUCTURE AND DIPHASIC VARIATION.

It may fairly be suggested that four possible variations in the arrangement and structure of the flagella may determine the H antigen pattern of diphasic Salmonella organisms:

1. "Simple" flagella may exist which contain only group or specific antigens; and it may *also* be essential that all the flagella on individual organisms are in the same phase.

2. "Simple" flagella only may exist but it may be possible for individual organisms to be provided with flagella in different phases.

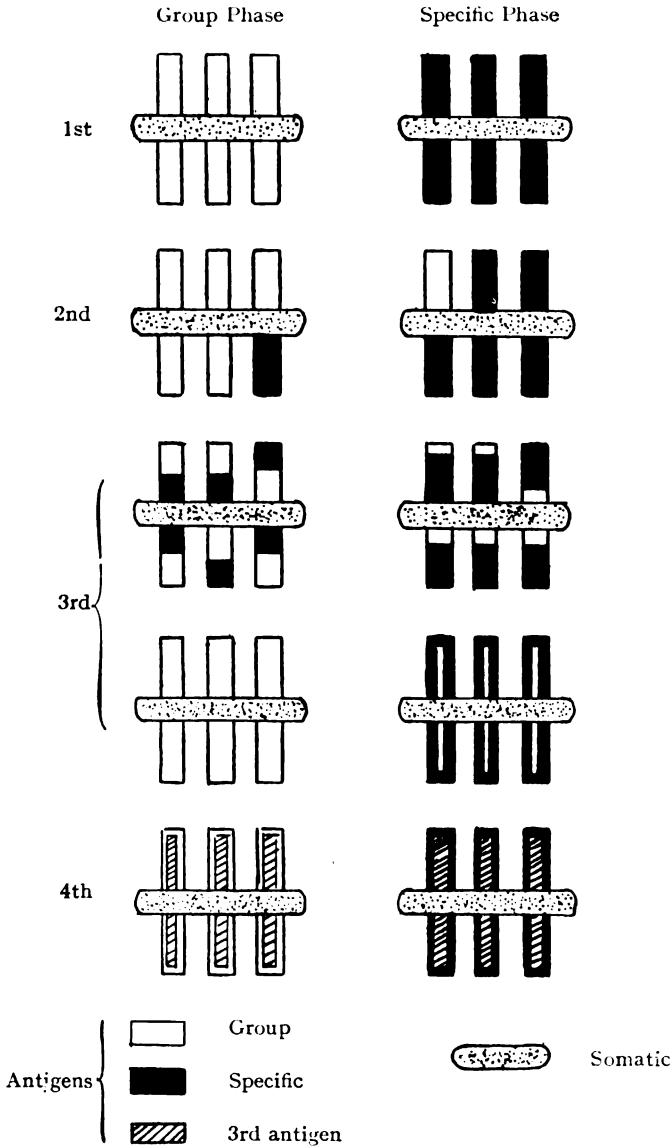
3. The flagella may be "compound" possessing both the specific and group antigens (*a*) both as surface antigens, or (*b*) having one as the outer covering of the core formed by the other.

4. The flagella may be "compound" possessing either group or specific antigens together with a basic antigen common to the species and related to the other H antigens somewhat as "R" antigens are related to smooth somatic antigens.

These four hypotheses are diagrammatically illustrated by fig. 1.

The First Hypothesis.

The truth of the first hypothesis, in conjunction with the theory of dominance and the persistence of organisms in the recessive phase, was



suggested by earlier observations and evidence both confirming this and refuting the third hypothesis can be obtained from the further experiments described below :

(a) *Experiments with Bact. paratyphosum B (Price).*

Two special suspensions for use as inoculums for immunizing rabbits were prepared and used as described :

Inoculum 1.—A suspension of *Bact. paratyphosum B* (Price) which behaved as a specific reagent *in vitro* was grown in *Bact. paratyphosum C*-serum-broth of high group titre to reduce the number of organisms present in the recessive group phase. Subculture into another tube of the same serum-broth was carried out on two successive occasions. The culture thus obtained failed to show "H" agglutination, i.e. was apparently an "O" culture. This suspension was formolized and a rabbit was injected intravenously with three doses at intervals.

The resulting "H" titres were :

<i>Bact. paratyphosum B</i> (specific)	1 5,000
Binns	1/40
Kunzendorf	1/80

Inoculum 2.—The same specific culture of *Bact. paratyphosum B* (Price) referred to above was transferred from *Bact. paratyphosum C*-serum-broth to a plate of soft agar also containing *Bact. paratyphosum C* serum to reduce the number of organisms in the recessive group phase while also diminishing the liability to "O" variation such as occurred in the first inoculum (Archer, 1941). Spreading growth occurred and a subculture was made from the edge of the growth to a similar plate. Each plate was subcultured to broth. Both the resultant broth cultures when tested showed specific "H" agglutination and did not react with Kunzendorf serum. These two cultures were mixed, formolized, and used as the inoculum for a fresh rabbit. Table I shows the immunological response elicited and, in contrast, the effect produced in another animal by the use of inoculums of *Bact. paratyphosum B* which had not been submitted to the action of group serum.

TABLE I.—GROUP AND SPECIFIC TITRES OF SERUMS PRODUCED BY THE INJECTION OF DIFFERENT INOCULUMS.

The following abbreviations are used in the tables and text :

Name of Organism	Abbreviation
<i>Bact. typhi murium</i> var. binns	Binns.
<i>Bact. thompson</i> var. berlin	Berlin.
<i>Bact. cholerae suis</i> var. kunzendorf	Kunzendorf.
<i>Bact. newport</i> var. puerto-rico	N.P.R.

			SUSPENSIONS			
" Specific "	Rabbit	No. of	Bact. paratypho-			
inoculum		injections	sum B (specific)	Kunzendorf	Binns	N.P.R.
Bact. paratyphosum B	13 40	3	1 80,000	0	0	0
" Inoculum 2 "	.. 13 40	5	1,40,000	1/160	—	1/320
Bact. paratyphosum B	91 39	4	1 80,000 +	1 3,200	1 1,600	1 3,200
(Price)		11	1 80,000	1 3,200	1 3,200	—
			0 = <1 40			

0 = < 1/40

(b) *Experiments with Bact. paratyphosum C (Hirschfeld).*

A specific culture of *Bact. paratyphosum C* which showed no group agglutination with Binns or Kunzendorf serums was inoculated into a tube

of *Bact. paratyphosum* B-serum-broth which had a high group titre. Growth occurred in the form of turbidity and a deposit. The turbid supernatant fluid was examined, found to be pure specific, and subcultured to a similar tube of *Bact. paratyphosum* B-serum-broth. Second and third serial subcultures were made. The supernatant portion of each of these cultures was found on examination to react *in vitro* as a pure specific suspension. That from the third subculture was used to immunize a rabbit, the result, together with the contrasting response produced by inoculums not passaged in a medium containing group serum is shown in Table II.

TABLE II.—GROUP AND SPECIFIC TITRES OF SERUMS PRODUCED BY THE INJECTION OF DIFFERENT INOCULUMS.

“ Specific ” inoculum	Rabbit	No of injections	Bact. paratypho- sum C (specific)	SUSPENSIONS		
				Kunzendorf	Binns	Berlin
<i>Bact. paratyphosum</i> C	9/40	3	1/16,000	1/160	0	—
Third subculture in group-serum broth	9/40	5	1/40,000	1/20,000*	0	0*
<i>Bact. paratyphosum</i> C	4/40	4	1/20,000	1/320	—	1/320
	4/40	10	1/16,000	1/3,200	1/400	—
<i>Bact. paratyphosum</i> C	16/36	5†	1/500	1/250	0	—

* = Group formula of both Kunzendorf and Berlin is 1.5. . . . (1.3.4.5). Comment on this anomalous result is made later.

† = Examined after 2 years.

(c) *Experiment with Bact. typhi murium.*

This organism was also grown in *Bact. paratyphosum* B-serum-broth (the serum used being similar to that present in the cultures of *Bact. paratyphosum* C described above). Results obtained by the use of the specific culture produced as an inoculum are shown (with controls) in Table III.

TABLE III.—GROUP AND SPECIFIC TITRES OF SERUMS PRODUCED BY THE INJECTION OF DIFFERENT INOCULUMS.

			SUSPENSIONS			
" Specific "	Rabbit	No. of	Bact. typhi	Kunzendorf	Binns	N.P.R.
inoculum		injections	murium (specific)			
<i>Bact. typhi murium</i>	10/40	3	1/50,000	0	1/3,200	—
subcultured in		3 (later bleed)	1/50,000	0	1/1,600tr.	—
group-serum-broth		5	1/80,000	0	1/640 + *	0*
		5 (later bleed)	1/20,000	0	1/1,600*	0*
<i>Bact. typhi murium</i>	94/39	10	1/64,000	1/25,600	1/25,600 +	—
<i>Bact. typhi murium</i>	32/36	7	1/50,000	1/10,000	1/50,000	—

* The group formula of both Binns and N.P.R. is 12 (1.2.3).

These results show a similar anomaly to that noted in Table II.

(d) A suspension of Binns, consisting of the supernatant portion of a subculture of this variant in *Bact. stanley* broth from a culture in soft agar containing *Bact. stanley* serum, gave rise on injection into a rabbit to the production of a specific titre of 1/5,000 and a group titre of 1/125 tr—.

Conclusion.—All these results demonstrate that, by growing a diphasic organism in the presence of group serum, a suspension may be obtained

which behaves as an almost pure specific antigen *in vivo* even when, as in the last experiment, the initial culture is a group variant. This finding accords with the hypothesis of recessive group antigens the organisms bearing which can be deposited, and so separated out when group serum is used in the medium in which the culture is grown, leaving in the supernatant fluid a much more purely specific culture than an ordinary culture in which the recessive group organisms are still present. On the other hand these results are *not* such as might be expected if "hybrid" group-specific organisms bearing "compound" flagella exist in accordance with the *third hypothesis*. In such a case the intravenous injection of flagellate diphasic organisms might be expected to produce reactions comparable to those which have been shown by Boyd (1938) to be produced by organisms having group and specific *somatic* antigens, namely the Flexner group of bacteria with respect to which he has demonstrated that specific strains almost always produce high group titres on injection so that pure specific serums can only be produced by absorption.

The Second Hypothesis.

The second hypothesis however is *not* excluded by the evidence already considered and, since various observations show that the existence of "hybrid" organisms can hardly be denied, some examples of such observations are given and will be examined with reference to this hypothesis.

OBSERVATIONS WHICH SUGGEST THAT "HYBRIDS" BETWEEN PURE GROUP AND PURE SPECIFIC ORGANISMS DO OCCUR.

(a) *Agglutination Results.*

In my previous paper I implied that suspensions which were not pure group or specific but mixed showed partial or incomplete agglutination with both group and specific serums rather than complete agglutination with either or both, suggesting that they were composed of *mixtures* of organisms in the group with others in the specific phase rather than being *homogenous* with the individual organisms containing both group and specific antigens, since, if this were the case, agglutination might be expected to be complete.

Further observations have not invariably strengthened this implication. Agglutination of mixed group and specific suspensions is *not always* only partial with each serum. Some examples of such observations are given below :

(1) A culture of *Bact. thompson* var. berlin in a soft agar-broth "U" tube produced a suspension which showed *complete* agglutination to titre with Kunzendorf serum and *partial* agglutination to 5 per cent of the specific titre (equal however to *twenty times* the group titre) of a *Bact. thompson* serum.

(2) A culture of *Bact. newport* var. puerto-rico in a "U" tube containing soft agar and *Bact. typhi murium* var. binns-serum-broth was subcultured on a plate and four colonies from the plate inoculated into four tubes of broth. Broth No. 2 produced a specific culture. The other three broth

cultures, on titration with a *Bact. newport* specific serum having a titre of $<1/25$ for *Bact. moribificans boris* (group), Binns, and *Bact. stanley* (group), gave complete agglutination to 20 per cent of the titre for Broth No. 2 (equal however to 100 per cent of the titre for a standard suspension of *Bact. newport* with an apparently different content of the *specific factors* e.h.) but were also agglutinated by Kunzendorf and *Bact. stanley* serums. (The latter it may be noted has no common "O" factors with *Bact. newport*.)

(3) Four suspensions of *Bact. paratyphosum* C were completely agglutinated by both *Bact. paratyphosum* C specific serum and Binns serum, though the group agglutination only occurred to a small fraction of the titre of the serum (the end-point of the specific agglutination was not estimated).

(4) In the course of the examination of several strains of *Bact. paratyphosum* B it was noted that, whereas several cultures were either almost pure specific or pure group and others showed obviously *partial* or *incomplete* agglutination with both group and specific serums, *one* culture of *Bact. paratyphosum* B (Cross) was apparently completely agglutinated by both specific and group serums.

Thus in four instances agglutination which was *not* partial (i.e. complementary) in each case was produced by the action of both group and specific agglutinins.

(b) Culture in Group Serum Broth.

Evidence of a rather more definite nature, also leading to the conclusion that "hybrid" organisms occur, was afforded by the behaviour of certain strains of *Bact. paratyphosum* B in cultures containing group antibodies :

A specific inoculum of *Bact. paratyphosum* B (Price) grew in *Bact. paratyphosum* C (group)-serum-broth as an almost complete deposit with a few floccules in the supernatant fluid. A subculture was made to a tube of the same medium and again growth consisted of a deposit. Further serial subcultures showed some turbidity but this was shown to be due to the development of the "O" variant. (This observation was actually made during the first experiment recorded in this paper the *final* result of which furnished evidence in favour of the *first* hypothesis !) The experiment was repeated with four strains of *Bact. paratyphosum* B, strains "Price," "Baker," "Rowlands," and "Cross." Examination of preliminary broth cultures showed that four of six "Price" cultures and two of three "Cross" cultures were specific. All of three cultures each of "Baker" and "Rowlands" were found to be group. Specific cultures of "Price" and "Cross" and cultures of "Baker" and "Rowlands" were inoculated into *Bact. paratyphosum* C (group)-serum-broth. No turbidity developed in the original cultures or in repeated subcultures of "Baker" or "Rowlands" while such as was produced in the cultures of "Price" and "Cross" was due to the production of the "O" variant.

Soft agar was inoculated from the supernatant portion of such cultures of "Baker," "Rowlands" and "Cross" and from a broth subculture of

the supernatant fluid of a similar culture of "Price." "Baker" produced a mixed group and specific growth (in this case agglutination *was* partial with each serum). "Rowlands" a predominantly group culture, "Cross" a predominantly specific culture, and "Price" a specific culture.

DISCUSSION.

It has been shown above that cultures of *Bact. paratyphosum* B strains "Price" and "Cross" in group-serum-broth fail to produce specific growth with turbidity.

On the other hand when such cultures were subcultured in soft agar specific suspensions were obtained.

This is an example of the agglutination of all motile forms *growing* in group serums, followed by the failure of group serum to agglutinate a subculture grown away from its action.

Such behaviour is difficult to explain but it might be due to the presence of scanty group flagella on organisms the flagella of which are predominantly specific.

Such scanty flagella might be sufficient to cause a failure of the organisms to separate after division in the presence of group antibodies while being at the same time too few to cause agglutination once separation has occurred.

An attempt was made to test this concept by washing such agglutinated deposits of *Bact. paratyphosum* B and resuspending them for titration with group and specific serums. The attempt failed as resuspension was not successful and auto-agglutination occurred.

The presence of higher proportions of group flagella might give rise to the type of result reported under "agglutination results," the organisms being agglutinated to a high percentage of the titre of the serum homologous to the more numerous flagella but to only a low percentage of the titre of that homologous to the more scanty flagella.

The findings marked with an asterisk in Tables II and III however and the failure of a *Bact. newport* serum to agglutinate Binns, *Bact. stanley* (group) and *Bact. morbificans bovis* (group) while having a titre of 1·125 tr. for *Bact. newport* (group), are more difficult to interpret since the application of this second hypothesis to the findings in Tables II and III with the assumption that the Kunzendorf and Binns suspensions used had a minority of specific flagella, leaves the absence of any approach to a constant ratio between the figures in column 4 (full specific titres) and those in columns 5 and 6 in Tables II and III respectively (titres due, on this hypothesis, to the minority flagella) unexplained.

The Third Hypothesis.

The existence of flagella bearing both group and specific surface antigens is rendered almost inconceivable by the ready manner in which suspensions which react with serums as either purely group or specific can be obtained.

The conception of compound flagella in which the specific antigens are the outer covering of the core formed by the group antigens, the relationship being thus similar in respect of flagellar antigen to the $S_{\text{core}} \rightarrow R$ relationship in respect of somatic antigens, receives a little support from the fact that there is evidence suggesting that group variation is in the nature of a degenerative change, though it has been demonstrated that in the case of *Bact. paratyphosum* B this change is not associated with any loss of virulence. Nevertheless, for the reason already stated in a review of the evidence in favour of the first hypothesis, I do not think that the third hypothesis in either form is acceptable.

The Fourth Hypothesis.

The hypotheses considered so far have failed to provide adequate explanation of the peculiar results noted in Tables II and III, and of the reactions exhibited by the *Bact. newport* serum referred to above, namely the marked difference in agglutinability as recorded in each table of two group suspensions, having the same formula although variants of different species, with the same serum.

A possible explanation of these anomalies is that they merely represent an extreme example of quantitative differences of group antigen components as illustrated in a previous paper (Archer, 1938), where it is demonstrated for instance that three different *Bact. paratyphosum* B serums showed the presence of group antibody 1 in the relative proportions 1 : 20 : 8 probably indicating an even wider divergence in the proportions of antigen 1 in the suspensions used as inoculums. If this be the true explanation however the occurrence of this difference favouring, in each of the three species, the agglutination of the homologous rather than the heterologous group variant seems a remarkable coincidence. (Table II shows that it is the homologous group variant Kunzendorf—homologous in the sense that it is a variant from the specific "C"—rather than the heterologous Berlin—a variant from the specific "K"—which shows the quantitative balance of the antigens 1.3.4.5. permitting agglutination by a serum which does not agglutinate the other organism having, on this assumption, some other quantitative balance of these same antigens. A similar conclusion follows an examination of the other series of findings referred to.)

These difficulties lead to the consideration of the fourth hypothesis which presumes the presence of a third flagellar antigen. The third antigen to accord with the findings would appear to form the core to an outer covering of either group or specific antigen and to be more or less unmasked according as this outer covering were more or less complete. In this respect the relationship would therefore, with respect to flagellar antigen, resemble that of rough to smooth somatic antigen. Unlike the rough somatic antigen, however, the third antigen would appear to be species specific. The hypothesis outlined above obviously affords an explanation of the findings so far inadequately accounted for.

The experiments recorded with the Binns and Kunzendorf suspensions could be explained by the unmasking to a considerable extent of such a third antigen.

The acceptance of the existence of such a third antigen dispenses with the compulsion to assume the existence of "hybrid" group-specific organisms and so displaces the second hypothesis since the phenomena which have led to such an assumption might equally be produced by group or specific cultures in which the third antigen is more or less masked.

No direct evidence of such a third antigen has been observed or reported however. The β specific phase may be the homologue of such an antigen in the *monophasic* organisms in which alone it has been described though with few exceptions this antigen is identical for most species rather than species specific. The matter requires much further investigation with absorption of group and specific factors from such sera as are partially analysed in Tables II and III to establish or refute this fourth hypothesis.

PRACTICAL APPLICATION OF THE OBSERVATIONS RECORDED IN THIS PAPER.

The practical application of the findings recorded above consists in the observation of certain precautions in the preparation of reagents for agglutination tests.

(1) The occurrence, in culture of diphasic organisms, of recessive antigens in the contrary phase indicates the advisability of culturing such organisms in the presence of group serum for the production of inoculums to be used for the preparation of specific serums. This method of culture will usually be effective and is simpler than the subsequent absorption of group agglutinins which will often otherwise be necessary.

(2) The same phenomenon, since it gives rise to the frequent failure to produce pure group serum, suggests that the homologous group serum should never be used (unless it has been carefully freed from specific agglutinins by absorption) to test the specificity of colonies of the diphasic *Salmonella* organisms by slide agglutination. Similarly the considerable quantitative variation of group agglutinins in different serums incidental upon a corresponding variation in group antigen components in different strains (Archer, 1938) suggests that a serum containing as nearly as possible the correct antibodies for the group phase of the organism under investigation (and not merely the universal antibody 1) should be used. Thus, for example, when testing cultures of *Bact. typhi murium* for their group or specific qualities neither Binns serum nor Kunzendorf serum, but N.P.R. serum should be used. Binns serum is not suitable since the presence of antibodies to the recessive specific antigen *i* may give rise to the false interpretation of specific colonies as group. Kunzendorf serum is also unsuitable since it contains the group antibodies 1.5 (whereas the group phase of *Bact. typhi murium* contains the antigens 1.2) so that it may, by variation in

antigen or antibody 1 content, give rise to the false interpretation of group colonies as specific. In contrast N.P.R. serum containing heterologous "O" antibodies, heterologous specific antibodies, and the homologous group antibodies 1.2 avoids such sources of error.

SUMMARY.

The antigenic structure of the flagella of diphasic *Salmonella* organisms is discussed and the evidence as regards the presence of group and specific antibodies in the same flagellum, the uniformity of the flagella on individual organisms and the possibility of a third flagellar antigen in the diphasic *Salmonella* species, is considered while a further line of investigation is indicated.

REFERENCES.

- ARCHER, G. T. L. (1938). *Journal of the Royal Army Medical Corps*, **71**, 4, 235.
Idem. (1941). *Ibid.*, **76**, 3, 143.
BOYD, J. S. K. (1938). *Journ. of Hyg.*, **38**, 4, 477.
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A FEW ELEMENTARY REMARKS ON HEAT STROKE.

BY MAJOR J. MACKAY-DICK, M.B., CH.B., M.R.C.P. EDIN.

Royal Army Medical Corps.

I AM prompted to write a few notes on heat stroke because, in my experience, there is a great deal of ignorance as regards the most obvious ætiological factors, prophylaxis, early recognition and treatment of this condition.

Normally in healthy individuals it matters not whether they live in a very cold climate or in a hot climate because, through the heat regulating centre, which balances heat loss and heat production, the average body temperature remains at, or about, 98.4° F. Now to those of us who live in a temperate climate there is no difficulty in keeping our body temperature at, or about, 98.4° F. We take no special precautions to ensure this because we are natives of that climate and we naturally keep ourselves warm by our native diet, dress and exercise. In such a climate, during the greater part of the year, we are concerned with the conservation of heat and we find no real difficulty in doing this, having done it automatically for a large number of years.

However in a hot climate, especially if the humidity is relatively high, we find a complete reversal in the state of affairs to which we are accustomed in a temperate climate. We are newcomers to a hot climate where it is common for the temperature to be well above the average body temperature. We are accustomed to drinking really large quantities of bland fluids and many individuals (essentially the troops and especially those in isolated areas) do not worry unduly if their bowels miss a day or two—some do not worry if their bowels are not opened for four or five days or even longer. In such a climate we are especially concerned with heat loss and the various methods of regulating this successfully. We therefore facilitate heat loss by the use of suitable clothing and by not over-exerting ourselves. We especially facilitate heat loss by (a) encouraging the free action of the skin in sweating. To make up for the fluid loss and chloride loss, and to keep up this action, we greatly increase our fluid intake and also (or we ought to) increase our intake of common salt. Deficiency of salt intake is characterized by lack of energy, lassitude, undue exhaustion, mental irritability, hypopieses, tachycardia and general malaise. It does not appear to be realized by many that, if we do not increase our salt intake, in a hot climate, at the same time as we greatly increase our fluid intake, we will sweat profusely and rapidly and wonder why the great increase of fluid intake has produced so little relief. However if the salt intake is also increased it is found that, although we have to increase greatly our fluid intake in a hot climate, marked benefit is obtained by ingesting fluid in quantities smaller

than those which produce so little benefit when the intake of salt is low.
(b) Ensuring a good easy bowel action once daily at least.

In addition we keep ourselves fit by judicious exercises at the appropriate time of the day and time of the year. We avoid alcoholic excess by restricting the consumption of alcohol either by complete abstinence or by not drinking alcoholic liquors until sundown and then, usually, we should not make a habit of having more than two or three drinks each evening.

Now if in individuals there is not a fine balance between heat loss and heat production, and should the latter gain the ascendancy, then the internal body temperature rises and continues to rise in no uncertain fashion until hyperpyrexia and the other signs and symptoms of heat hyperpyrexia appear. There is no doubt that constipation, injudicious consumption of alcohol and the inadequate intake of bland fluids and common salt, impose an excessive strain on the heat regulating mechanism when the humidity is high or in a very hot climate where the humidity is relatively high. It is my belief that if such individuals suffer an elevation of temperature from any cause, especially from one of those conditions characterized by rigors, where there is a sudden and dramatic rise in the internal body temperature such as occurs characteristically during the rigor stage of malaria, then this increase in internal body temperature is such that the already sorely tried heat regulating mechanism cannot cope with it and it fails. As a result the temperature shoots up with dramatic suddenness to 106° F.—107° F. or even higher. The patient rapidly develops the other signs and symptoms of heat hyperpyrexia (heat stroke), and in a relatively short space of time he becomes comatose. Unless such cases are properly and adequately treated by all appropriate measures, for heat stroke as well as the emergency treatment for malaria if that condition be also present or even suspected, then there will be a relatively high mortality.

There is one rule which should be adopted by all medical officers in very hot climates with a relatively raised humidity or where the humidity is high, namely "Regard all febrile cases admitted to hospital as potential cases of heat stroke and carry out prophylactic treatment as well as the treatment for the condition from which the patient is suffering." If this is done zealously by all Orderly Medical Officers and Nursing Sisters then no cases of heat hyperpyrexia should develop or, anyway, reach maturity in hospital. This suggested rule may appear to be extreme but it will be recognized as a very sound one by all medical officers who have really seen and treated true cases of heat hyperpyrexia. It is my opinion that heat hyperpyrexia is the cause, in a very large percentage of cases, of the continuation of fever which is seen in many cases of malaria *under adequate quinine therapy*.

Such cases of malaria are frequently mentioned in hushed voices and how often have I heard the remark "You have a very severe (or resistant) type of malaria in such and such a district." I believe that if in addition to adequate treatment for malaria such patients are given an enema on admis-

sion to hospital as well as fluids *ad lib.*, calomel grs. iii followed by salts, tepid sponged frequently and nursed under a fan from the moment they are admitted to hospital then prolonged fever in adequately treated cases of malaria *will not occur*. There is no doubt in my mind that the prolonged fever in such cases is not really due to malarial infection but is due to unrecognized and untreated incipient heat stroke which has been precipitated in a patient so predisposed.

Another type of case, the true nature of which is not infrequently missed in the early stages, is the individual who is admitted to hospital with low fever, vague pains in the loins and/or lower abdomen, slight dysuria and with a few pus cells in the urine. He is usually treated primarily as a case of urinary infection. Soon after admission or on the next day his temperature shoots up to 106° F. or thereabouts and it is finally recognized that he is now a definite case of heat hyperpyrexia.

Why are such cases of incipient heat hyperpyrexia frequently missed on first admission to hospital? The answer is that it is not sufficiently recognized (*a*) that it is common to find pus cells in the urine of individuals (Europeans) living in a very hot climate and who drink insufficient quantities of bland fluids; and (*b*) that the other signs and symptoms presented by such patients are also characteristic of the incipient case of heat hyperpyrexia.

I would commend the following suggestions to all medical officers newcomers to Africa or similar climates.

(1) In the very hot weather regard all febrile cases admitted to hospital as candidates for heat stroke and institute all measures for the prevention of the development of this condition. This includes the adequate treatment of the condition primarily responsible for the patient reporting sick.

(2) In all cases showing fever of any type, even when the cause may appear to be obvious, never forget that the patient may also have malaria. In addition if any febrile condition is not responding as well to your treatment as it should then consider malaria. If you can find no evidence of the latter condition then the mere fact that the patient may have been exposed to malarial infection some time in his career is sufficient justification for the exhibition of quinine in adequate doses.

(3) Advise all personnel in your unit on the potential danger of consuming liquor before sundown and of alcoholic excess.

(4) Avoid constipation in your unit and see to it that everyone gets as much fluid as possible.

In addition I would suggest that the extra salt ration should be given in the form of salted nuts.

ACKNOWLEDGMENT.

Major-General P. S. Tomlinson, *D.S.O.*, *M.R.C.P.*, *D.M.S.*, Middle East, for permission to forward these notes for publication.

PLAN OF A TENTED FIELD OPERATING THEATRE AS USED BY THE 18TH GENERAL HOSPITAL AND SUGGESTED MODIFICATIONS

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THE theatre, which was constructed in the Spring of 1940, was situated on sandy soil at Etaples. It was rendered almost dust-proof by double tentage and a lining of bed sheets which could easily be changed. It was a windy area and to prevent sand being blown about when the patients were admitted the entrance was made 12 feet in length to allow closure of the porch flaps with the stretcher in the entrance before admission to the theatre.

The whole floor space from the office of the Officer i/c Surgical Division, which was also the surgeons' changing room, and including the sterilization and blood transfusion tent, had a good smooth concrete floor with gullies at the edge for drainage. A wall of sandbags protected the theatre block.

The theatre tent, consisting of four sections and two ends, was divided by wooden uprights and skeleton framing for bed sheets to make four separate theatres. These theatres could be considered as two units, each consisting of a large theatre 18 by 11 feet, and a smaller one 14 by 9 feet. The almost central entrance and corridors made through traffic in the theatres unnecessary and added greatly to the cleanliness, quiet and separation of each team.

This separation of the main theatre tent into separate units is emphasized as the valuable feature in this plan. The corridor to the single sterilizing room was, however, for busy times, rather narrow, being only 3 feet wide. In the sterilizing room, which consisted of two sections and two ends, corrugated iron sheeting replaced the tent wall behind the "Man-love" sterilizers. The condensed steam from these Manloves was used to heat a 40-gallon drum of water to 200° F. This gave us a good supply of warm water. Boiling water for general purposes was provided by an ingenious device. A "Tommy boiler, water, copper, 5 gallons," which could not be kept boiling by Primus stoves underneath it, could be kept boiling by one Primus stove when water heated in a biscuit tin was syphoned off continuously into it. Also included in this outfit was a brick gallery for heating pans over Primus stoves. Any device to use to advantage the relatively small number of Primus stoves which are supplied is of the greatest value. The six fish kettles heated by spirit lamps for the sterilization of instruments were grouped together in the sterilizing room. Two ward sinks were fixed 4 feet apart and formed a support for an intervening

table. Two pack store racks furnished useful storage for the sterilized drums.

The instruments were arranged in separate drums into five basic dissecting sets. The extras for two abdominal, two cranial and one chest set were kept separately. The fracture instruments, pins and drills and saws, were kept in Dettol on the upper and stirrups on the lower shelf of one of the instrument tables.

In theatre No. 2 there was a supply of sized Thomas splints and, as three operating tables only were available, the table for this theatre was a simple wooden trestle bench. A Bohler distraction apparatus was supplied

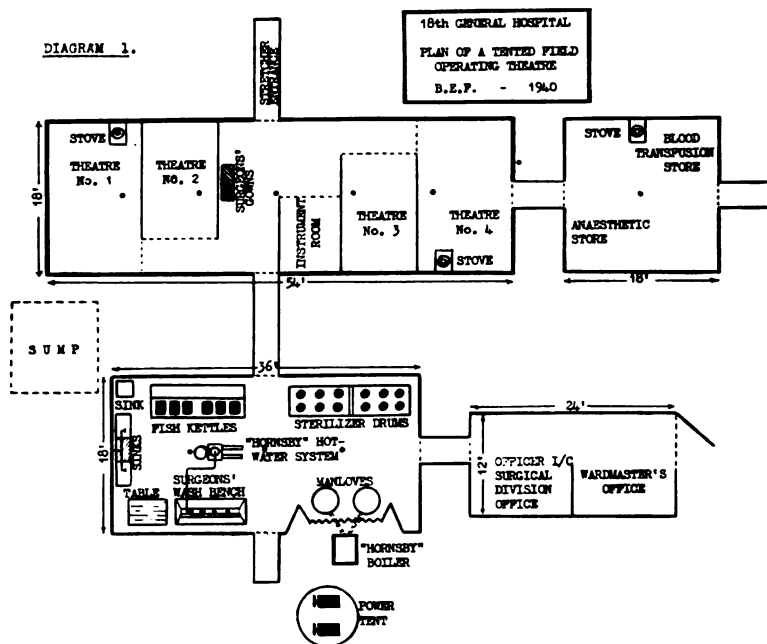


DIAGRAM 1.

in each theatre. A plaster table was constructed to be moved to any theatre as required.

The many different appliances for taking and giving blood were sterilized and stored together under the charge of a Blood Transfusion Officer. It was envisaged that all blood would be taken here (from our own donors) and, although some might be given here, the main place for infusion would be in the theatres or the resuscitation ward which was nearby.

Excellent lighting was supplied from the two emergency 100 volt. 40 kw. generators. Four 40 watt lamps suspended from a simple wooden frame gave a good light in the smaller theatres and in the larger theatres six 40 watt lamps fitted in a tin canopy gave a most satisfactory illumination.

It is important to remember the tremendous heat generated by these lamps when a canopy is made with a wooden framework.

The generous supply of tentage and the concreting of this large area was obtained through the personal interest of the Commanding Officer who, with Lieutenant-Colonel A. B. Pain, R.A.M.C., was responsible for the basic layout.

An invaluable craftsman materialized in the person of Serjeant D. Hornsby, R.A.M.C., who planned and made the apparatus to use the condensed steam to obtain warm water and constant boiling water in the adapted "Tommy" boiler. He also made the canopies for the theatre lighting.

The internal design of this theatre was based on the idea that at certain

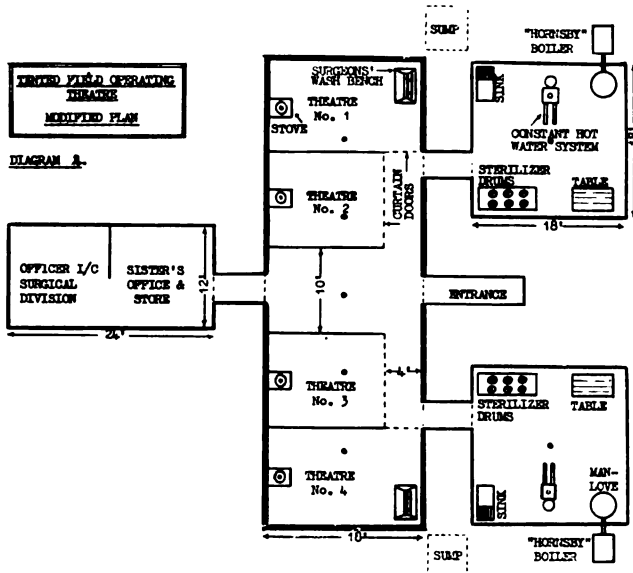


DIAGRAM 2.

periods so many cases would need operations of either a minor or major surgical importance at the same time that four separate theatres would be useful. Further reflection on the theatre organization and particularly discussion with Lieutenant-Colonel W. E. M. Mitchell, *M.C.*, R.A.M.C., has led me to modify the original plan. It has been proved by experience that cases can be most expeditiously treated if one surgeon has two theatres with assistants rather than each theatre working simultaneously.

Diagram 2 represents a complete tented theatre unit with the basic feature of two theatres connected with a sterilizing room. For this scheme less tentage is required than for Diagram 1 and this in itself is a very important item. It will be seen that in the middle of the theatre tent a large space is available opposite the Sister's Office and Storeroom for the accom-

modation of patients who are admitted through an entrance well protected by the sterilizing tents on each side.

The theatres consist of two larger 18 by 11 feet and two smaller 14 by 11 feet. A surgeon's wash basin is provided in the corridor portion of each larger theatre and this will be found very convenient for the surgeons who wash between each case. Each theatre would have its own fish kettle rather than having them grouped together in a somewhat distant sterilizing room. This will make each theatre more and more an independent unit.

The sterilizing room consists of two ends 18 by 18 feet and in addition to the sink, table and drum rack, could contain one "Manlove" sterilizer also heating the "Hornsby" boiler and one "Hornsby" boiling water device.

In this way it is thought the best use of the excellent equipment provided in the field can be made.

My thanks are due to my Commanding Officer, Colonel F. Whalley, *D.S.O.*, *T.D.*, *K.H.P.*, for his suggestion and permission to publish this article ; also to my colleagues, particularly Major J. M. P. Clark, *R.A.M.C.*, and to Lance-Serjeant G. A. Bramley, *R.A.M.C.*, for his excellent diagrams.

NOTES ON LEECH INFECTION IN THE MIDDLE EAST.

BY CAPTAIN BRIAN REEVES, F.R.C.S.ED.

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SINCE time immemorial the leech has been a source of trouble to the population in the Middle East and the symptoms caused are well recognized.

Gideon was wise to the potential danger of the leech when he chose his army of 300 men—"So he brought down the people unto the water: and the Lord said unto Gideon, Everyone that lappeth of the water with his tongue as a dog lappeth, him shalt thou set by himself; likewise everyone that boweth down upon his knees to drink.

And the number of them that lapped, putting their hand to their mouth, were three hundred men, but all the rest of the people bowed down upon their knees to drink water."

Several species of leech are found in Palestine and N. Africa, *Limnatis nilotica* being the most common. Drinking water from wells is a source of infection. The young leeches are only 3 mm. long. They attach themselves to the mucosa of the mouth, nose, larynx or trachea, remaining and growing there until they cause symptoms. They may cause headache and obstinate epistaxis resulting in severe and fatal anæmia. Sometimes the bite becomes infected and an ulcer is formed.

In *Hirudinæ* there are three semi-circular jaws having from 50 to 100 sharp teeth. The salivary glands are situated inside the mouth cavity, and secrete fluid preventing coagulation of blood. When the leech becomes detached from the mucosa the wound continues to bleed because the effect of the salivary secretion in retarding coagulation is of some duration.

We learn that the *Limnatis nilotica* is a source of trouble to the French troops in Algeria. Napoleon's Army in its retreat through the Sinai Peninsula was also inconvenienced by the leech. Several cases of leech infection were observed in British Troops in Egypt and Palestine in the last war.

It is for these reasons that the report on two cases may be of interest to medical officers serving in the Middle East at the present time, especially those "in the field."

Both patients were adult Arabs from Northern Palestine. They complained of "something moving in the throat," making them cough. They were both aware of the nature of the foreign body. They were accustomed to drinking well water.

Attempts at removal had been made by the patients themselves with their own fingers. Removal with forceps by means of indirect laryngoscopy had also failed.

The patients were shown to me at this stage. Both were coughing and

salivating freely, the saliva being blood-stained. Both were hoarse but not unduly distressed.

Indirect laryngoscopy revealed a blood-stained œdematous larynx with injected vocal cords. Nothing else was visible on inspiration. At the end of expiration a small shiny brown body presented itself between the cords. This was the unattached end of the leech which was blown out of the trachea by the expired air. It was sucked in again during inspiration and disappeared from view. Diagnosis, leech in trachea.

In both patients leeches were removed by direct laryngoscopy under general anaesthesia. Ether vapour appeared to have no effect on the leeches which were grasped with Patterson forceps. Considerable force was required to remove them from the mucosa. There was no undue bleeding from the trachea after removal.

The leeches were alive and undamaged, they measured 1.5 cm. and 3.5 cm., after being killed in 10 per cent formalin in normal saline.

If local anaesthesia be used (cocaine spray and laryngeal syringe) with the patient in the sitting position, a bronchoscope should be ready for immediate use in case the leech becomes detached and falls down the trachea or into a bronchus.

Even using a general anaesthetic it is reassuring to know that a bronchoscope is available.

SUMMARY.

- (1) Notes on leech infection of historical interest.
- (2) Source and manner of infection and symptoms which may be caused.
- (3) Report of two cases of leeches in the trachea, presenting with cough and hæmoptysis.
- (4) Advisability of having a bronchoscope available during removal of leeches from the trachea.

Editorial.

PENICILLIN.

AFTER reading the very valuable paper by H. W. Florey and a group of Oxford workers in the *Lancet* of August 16, 1941, in which was described a method of extraction of penicillin from culture, a method of assay, the characteristics of the anti-bacterial action and a number of other qualities, we thought it as well, in the interests of history, to turn back, once more, to the original paper by Fleming in 1929 after his discovery of the mould then thought to be *Penicillium rubrum*, but now known as *Penicillium notatum*. "While working with staphylococcus variants," says Fleming, "a number of culture plates were set aside on the laboratory bench and

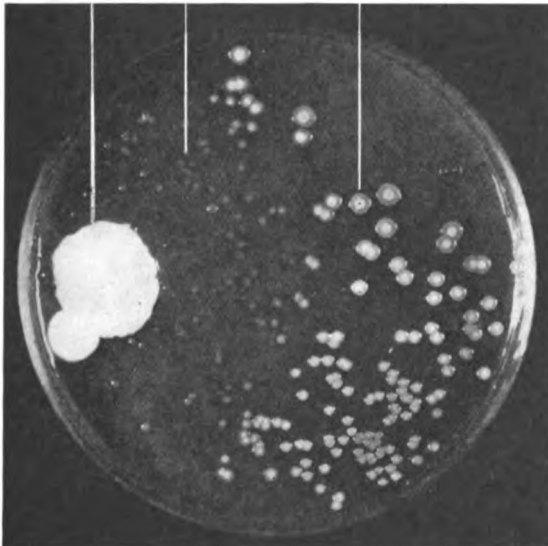


FIG. 1.—Fleming's original plate. Around a large colony of a contaminating mould the staphylococcus colonies became transparent.

By courtesy of H. K. Lewis & Co.

examined from time to time. In the examinations these plates were necessarily exposed to the air and they became contaminated with various micro-organisms. It was noticed that around a large colony of a contaminating mould the staphylococcus colonies became transparent and were obviously undergoing lysis" (fig. 1).

The mould is the penicillium which is now used to produce its anti-bacterial extract and which will, doubtless, be very largely employed for this purpose in the future if some other creature is not discovered to produce still more anti-bacterial poison on a more easily exploited scale.

With this mould at his disposal, Fleming began an intensive study of it from every point of view and, more particularly, from the direction of its anti-bacterial power. It is quite extraordinary what a generous contribution he made to a comparatively unknown field of bacteriology in the course of this investigation. A number of other moulds were examined for their power to inhibit the growth of bacteria but none was found to share this quality to an appreciable extent, not even other varieties of penicillium itself. He described "the simplest method of examining for inhibitory power," by cutting a furrow in an agar plate and filling in with a mixture of

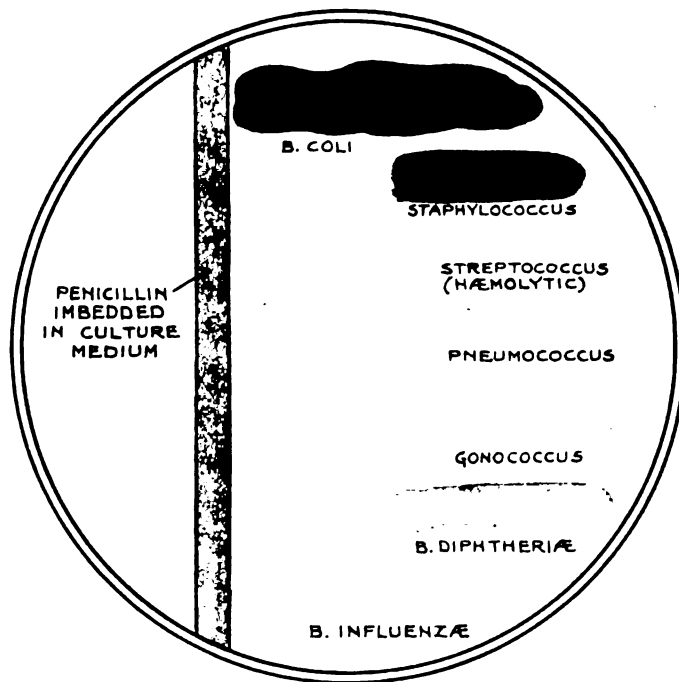


FIG. 2.—Specific bacteriostatic qualities of the *Penicillium* for certain organisms and not for others.

By courtesy of H. K. Lewis & Co.

equal parts of agar and the broth in which the mould has grown. "When this has solidified, cultures of various microbes can be streaked at right angles from the furrow to the edge of the plate." We re-publish above a picture from the original article in which this technique was illustrated. It will be noticed that Fleming had already discovered the specific bacteriostatic qualities of his penicillium and was demonstrating by this means the inhibitory power of his culture for staphylococcus, *Streptococcus hæmolyticus*, pneumococcus, gonococcus and *B. diphtheriæ* and its complete want of inhibitory action against *B. coli* and *B. influenzae* (fig. 2). It may be added that he

also described how to accurately titrate a broth culture by making serial dilutions, "and then implanting all the tubes with the same volume of a bacterial suspension and incubating them."

Fleming also called attention to the effects of heat ; that one hour at boiling point reduces the anti-bacterial substance to less than one quarter if the fluid is alkaline but much less so if the fluid is neutral or slightly acid, and "that autoclaving for twenty minutes at 115° C. practically destroys it." He found that filtration through a Seitz filter failed to diminish the anti-bacterial power (though it is now pointed out that some diminution may result from this procedure) ; that the active principle is freely soluble in water and weak saline solution ; that, evaporated at low temperature to a sticky mass, it can be completely extracted by alcohol but that it is insoluble in ether or chloroform. He noted that 20° C. was a suitable temperature for growth, that cultures failed at 37° C., and that the formation of anti-bacterial substance was progressive for about eight or ten days after which it fell, being practically gone after fourteen days. He found that penicillin belongs to the group of slow-acting antiseptics and that staphylococci are only completely killed after an interval of over four and a half hours. With regard to its toxicity he showed that it was practically non-toxic for laboratory animals and that it had no more toxicity to leucocytes than had the broth in which the mould was grown. Fleming pointed out in his first publication that "it can be applied to an infected surface undiluted as it is non-irritant and non-toxic. If applied therefore on a dressing it will still be effective even when diluted 800 times which is more than can be said of the chemical antiseptics in use. Experiments in connexion with its value in the treatment of pyogenic infections are in progress." In his summary, too, he speaks of its probable clinical application ; "It is suggested that it may be an efficient antiseptic for application to or injection into areas infected with penicillin-sensitive microbes." He tried his anti-bacterial substance in treatment to a limited extent and with some success. The difficulty, as he says, is the instability of the active principle which will not keep in watery solution, but he has used the substance regularly up to the present time in the differential culture of influenza bacilli and other insensitive germs. Clutterbuck and Raistrick in 1930 confirmed Fleming's findings and introduced a modification of a well-known medium for growing moulds in which Fleming's penicillium produced a good yield of penicillin.

The matter rested for some years and more recently Professor Florey and his team of collaborators have taken over the work. In their paper in the *Lancet* they examine the question anew and describe their findings. "Penicillin," they say, "can be extracted by ether, amyl acetate and certain other organic solvents from an aqueous solution whose pH has been adjusted to 2. From the organic solvent the penicillin may be extracted by shaking with phosphate buffer or with water the pH of which is kept at 6-7. Penicillin is quickly destroyed at pH 2 at room temperature so the first extraction must be carried out rapidly or at low

temperature. Once it has been extracted into solvent the penicillin is stable for some days." The penicillin-containing solvent as delivered from the extraction apparatus is now treated after a manner for which the original paper must be consulted. "Finally the penicillin is extracted back into water using sodium hydroxide to adjust the pH, . . . the 'non-pyrogenic' or 'therapeutic' fraction, which contains perhaps 80 per cent of the penicillin put through the column, is extracted into pyrogen-free water, all glassware having been rinsed with the latter. It is a deep reddish-orange fluid, yellow in dilute solution, with a faint but characteristic smell and a bitter taste."

The bacteriostatic power of penicillin is found to be much greater against staphylococci and haemolytic streptococci than that of the sulphonamides and is only influenced to a minor degree by the number of bacteria to be inhibited.

Its bacteriostatic power is not inhibited to any appreciable degree against staphylococci and streptococci by hydrolytic protein breakdown products or products of tissue autolysis or pus. "Penicillin is less toxic to leucocytes *in vitro* than the sulphonamides." As stated by Fleming, the extract is found to be harmless to living tissues in practical dilutions. "These results . . . strongly support the view that local applications of quite strong solutions should prove innocuous to tissue cells."


Experiments on the rabbit, the cat and man prove that, while the rabbit is the best able of the three to inactivate penicillin, the cat and man allow of the detection of activity in the blood and in the urine.

Finally, in five cases in humans, all of extreme gravity, the penicillin proved of sterling worth as far as supplies would allow of its use; in a sixth it was successfully given by the mouth along with sodium bicarbonate in a case of urinary infection with staphylococci; and in three cases of severe eye trouble, it was used with success as a local application.

Clear descriptions of the method of assay, a modification of Fleming's original method, and of the large-scale production of penicillin, are given and the details of the cases are stated with the utmost frankness and with extreme care. Professor Florey and his associates are to be congratulated on what promises to be a wonderful blessing to humanity.

THE LORD ROBERTS MEMORIAL WORKSHOPS FOR DISABLED SOLDIERS AND SAILORS.

IN our issue of September, 1937, on page 213, we published a letter from Lieutenant-General Sir George MacMunn, *K.C.B.*, *K.C.S.I.*, *D.S.O.*, appealing for the Lord Roberts Memorial Workshops. We make no apology for a still further appeal in this number. Every soldier knows how essential is this kind of training or re-training. Many are deprived of the power of following their previous occupation through the loss of a limb or the loss of power. For such men, the kind of instruction given in these Workshops is imperative. Now, in a time of war, the number of men applying for re-training is naturally very great and, in the future, is certain to be greater still. It is right that we should subscribe to this wonderful work, not only out of love and respect for a great soldier gone before us but out of the wish to help those who have been or may be stricken on the field of battle. Donations should be sent to the Honorary Treasurer, Lord Roberts Memorial Workshops (Admiral of the Fleet Sir Roger Keyes, Bt.), at 122, Brompton Road, Room T, London, S.W.3.



Clinical and other Notes.

SHAFTESBURY MILITARY HOSPITAL MEDICAL SOCIETY.

HEAD INJURIES.

By COLONEL CAIRNS.

COLONEL HUGH CAIRNS dealt first with the clinical features observed in cases of gun-shot wounds of the head and said that they differed in several respects from those following injuries by blunt objects. Unconsciousness at the moment of impact was often absent ; amongst twenty-nine cases of penetrating injury only six lost consciousness at the time. Retrograde amnesia, too, was not so frequently encountered. Delayed loss of consciousness might be due to the spread of intracranial hæmorrhage but it might sometimes be found to be due to dosage with morphia, the routine $\frac{1}{4}$ grain being too large a dose for these patients. In those cases in which consciousness had been lost, the injury had been to the base of the brain, often in the cerebellar or hypothalamic region, and this provided an interesting parallel to the experience that at operation a large amount of the cortex might be removed without unconsciousness resulting whereas effusion of blood around the brain-stem would rapidly produce this result. It was possible that the cortical activity associated with consciousness was maintained by a flow of afferent impulses by way of the thalamus and that interruption in this locality or in other parts of the brain-stem was more important than damage to the cortex.

In contrast to the small incidence of disturbances of consciousness focal signs were much more commonly seen than in the case of blunt injuries and this was the case even if the skull had not been penetrated by a projectile. These focal signs often cleared up rapidly and, in the case of a man who, immediately after injury had been completely paralysed, the use of the limbs returned within a few minutes and within a few days complete blindness had been replaced by a residual quadrantie hemianopia.

Gunshot wounds displayed a greater liability to infections of the brain even if the skull had not been opened. Wounds of the scalp especially showed this tendency and it would seem that the associated injury to the skull, even in the absence of a fracture, rendered the bone more pervious to infecting organisms, for two out of fifteen cases of scalp wounds unassociated with fracture developed intracranial abscesses.

The remarkably high incidence of epilepsy after gunshot wounds of the head had been demonstrated recently by Ascroft. Fits occurring in the first two weeks after injury were not uncommon but such fits need not be regarded as any indication that epilepsy would become established later.

The treatment of gunshot wounds of the head must be early and thorough.

In view of the dangers of infection from even a small scalp wound, these injuries must receive the utmost care. To ensure this a large area around the wound should be shaved—two sharp razors and a strop were indispensable—and the area anaesthetized by an adequate regional block. Having cleaned the wound and excised the damaged tissue, the bone should be explored and if there was any evidence of a depressed fracture one should explore between the bone and the dura to detect any in-driven fragments, making a small burr-hole through the skull if necessary. The dura should be left clean but unless it appeared purple it was not advisable to open it. The wound should be packed with a sulphanilamide paste; this was also useful if for any reason operation had to be delayed for the paste might be immediately applied to the wound and the operation safely postponed for several hours.

Regarding the treatment of blunt head injuries, if a patient was unconscious and operation was not indicated, progress depended largely upon the efficiency of the nurse; the swallowing reflexes were usually present and by constant attention adequate nourishment could be given, while, if the reflexes were lost, a stomach tube would be required and this might be left in position for a week at a time. These patients were often left completely undisturbed by the nurse but this was undesirable for the shallow breathing which resulted had been found to raise the intracranial pressure; it was better to turn the patient at intervals to ensure deeper breathing as well as to prevent bed-sores. Even for restless patients morphia was required in small doses only; gr. $\frac{1}{8}$ was sufficient in most cases, and this might be repeated after two to three hours when the effects of the previous dose had worn off. It was important in all cases to observe and record those signs which indicated the depth of unconsciousness so that any alteration might be quickly detected.

With regard to the period of recovery, it was unwise to keep a case of mild concussion too long in bed and then to expect a rapid return to normal life. A man whose unconsciousness had lasted for less than six hours might get up by stages after a week if free from headache but return to full duty should not occur until he had passed through a convalescence in which increases in activity had been carefully graded up to the final stage of violent exercise.

A SYSTEM OF SEWAGE TREATMENT APPLICABLE IN THE FIELD.

BY MAJOR G. V. JAMES,
Royal Army Medical Corps.

ARISING out of a complaint that a well used as a source of water supply by troops and inhabitants alike was polluted by a nearby deep trench latrine, the need for an improved method of sewage purification in the field was recognized.

Usually, on active service, sanitation is improvised and hence is imperfect, but a suggestion was to receive the sewage in caustic soda which was then tipped into a soakage pit or removed by trenching. This has the serious drawback that a high pH may be produced in the soil and that the subsequent purification in the ground may accordingly fail. Further, it was thought that the caustic soda might splash during use and injury to the person occur. The idea of preventing the splashing by either a layer of oil or by mechanical means was mooted.

The disadvantage of the oil layer is similar to that of the caustic soda as it will affect the biological activity of the soil by forming an impermeable oily layer over the sewage through which oxygen cannot penetrate.

The anti-splash methods introduced by Major Turner (3rd Field Hygiene Section) and the methods of separation of urine and faeces suggested by Major Greenfield (7th Field Hygiene Section) and Major Finlayson (13th Field Hygiene Section) were so good that it was decided to superimpose the chemical purification on to these systems.

The following is an account of experiments performed with the idea of improving the quality of the liquid to be discharged by use of chemicals which can be easily obtained in the field. It was of course realized that peace time standards of purity had to be scrapped and the main desideratum was to purify the sewage so that it would be less polluting should it gain access to water used for human consumption.

Urine.—The urine is separately collected in a receptacle containing lime. This lime raises the pH of the liquid to 9.5 so that bacterial decomposition in the receptacle and odour production are prevented.

An experiment was also performed using bleaching powder in the receptacle. Smell was effectively stopped and, whilst the pH was raised, urea was decomposed and the liquid was rendered less valuable as a fertilizer when applied to the soil. Further, the residual chlorine hinders bacterial action in the soil so that the use of lime is to be preferred.

The limed urine is run into a soakage pit whence it is absorbed.

Faeces.—The faeces are collected in 20 per cent caustic soda and are found to become sterile in one hour, so any purification must be by chemical processes. One point has been raised as to how long the alkali would last before replenishment is necessary. The optimum time is of course the time at which maximum digestion occurs. The following table shows that this is about six days after the last addition of faeces.

TABLE I.—RESULTS ARE P.P. 100,000 OXYGEN ABSORBED.

	Time in days after start of experiment								
	0	1	2	3	4	6	8	9	11
Permanganate absorption	80	180	280	200	230	300	200	290	310
Hypochlorite absorption	130	130	350	180	420	217	242	227	265
Ratio of hypochlorite to permanganate	1.8	1.3	1.2	1.0	1.8	7.3	11.8	8.0	8.6

The chemistry of the process deduced from the ratio (the ratio is explained elsewhere) is that the faecal proteins are degraded to simpler digestion products, but there is no advantage in prolonging the digestion more than a week.

Purification by precipitation was continued on two different specimens of liquid, one after two days standing and the other after seven days standing. The two days was tried as it may be necessary to curtail the digestion period somewhat due to enemy activity.

The liquid was diluted with water or ablution water (urine would raise the oxygen absorption too much), the optimum dilution being 1 volume of sewage and 8 volumes diluting fluid. These dilutions were then treated with ferrous sulphate and bleaching powder in various ratios so as to coagulate the suspended matter. Sedimentation proceeded for four hours.

TABLE II.—OXYGEN ABSORPTION AFTER FOUR HOURS SEDIMENTATION.

No treatment	94	p.p. 100,000
225 p.p.m. FeSO ₄ : 50 p.p.m. CaOCl	26	
300	75	38
350	100	33

The most advantageous concentrations are hence 225 p.p.m. ferrous sulphate and 50 p.p.m. bleaching powder.

The bleaching powder is superior to lime as the following results show :

TABLE III.—OXYGEN ABSORPTION, COMPARISON OF COAGULANTS.

	2 days	7 days
Untreated	95	p.p. 100,000
225 p.p.m. FeSO ₄ : 50 p.p.m. CaO	26	16
225 p.p.m. FeSO ₄ : 59 p.p.m. CaOCl	38	25

The suggested treatment is hence resolved to : Separation of urine and fæces, the urine being collected in receptacles containing lime and disposed of by a soakage pit.

The fæces are collected in 20 per cent caustic soda and, when collection is completed, are allowed to digest in the alkali for a week (there is no smell produced during this procedure) after which the liquid is diluted with eight times its volume of water or ablution water and treated with 225 p.p.m. ferrous sulphate (16 grains per gallon of liquid) and 50 p.p.m. bleaching powder (about 4 grains per gallon). The reagents are made into solution before adding to the sewage liquid. The whole is thoroughly agitated and then allowed to sediment in covered containers for four hours. The supernatant liquid is then removed and disposed of by a soakage pit, roofed with turf (to prevent fly nuisance), while the sludge can be dried in the air without nuisance, and either burned in an incinerator or disposed of by trenching.

It is claimed that this method will require less labour than the use of deep trench latrines. It is less polluting to water supplies and to the ground since a higher degree of purification is reached, although it is an improvised method, while the cost of chemicals is low and they are easily obtainable.

AN ALTERNATIVE TO THE CLOVE-HITCH HALTER, FOR USE WITH THE THOMAS' SPLINT.

BY LIEUTENANT G. COHDA,

Royal Army Medical Corps.

EXPERIENCE in the training of R.A.M.C. personnel in the method of application of Thomas' splint has demonstrated to me various disadvantages in the use of the clove-hitch halter for maintenance of extension as recommended in the R.A.M.C. Training Manual. I have therefore experimented with several alternatives and the one about to be described is, I think, far superior in every way.

Briefly my objections to the clove-hitch are as follows :

(1) The difficulty in the formation of the hitch encountered, in spite of prolonged instruction according to the admirably simple method described in R.A.M.C. Training Manual (para. 627 ; sub-para. 111 ; sect. (ii)). The multiplicity of methods used in the formation of the clove-hitch is testimony to this difficulty.

(2) The loops of the hitch are invariably either too large or, more often, too small. This necessitates re-adjustment, in the former case whilst the loops are on the boot, leading to pain and discomfort to the patient ; and in the latter case, before the loops are applied, leading to some waste of time or, as usually happens, to a re-formation of the hitch.

(3) The temporary manual extension being applied by No. 2 bearer is inevitably disturbed in order to apply the loops of the hitch. In the presence of a wet or muddy boot the re-application of the hands after the passage of the loops is often difficult and has, in my experience, led to occasional dropping of the foot with obvious result to the patient.

The above points may not seem a very formidable array at first sight and probably are not the only disadvantages of the clove-hitch but in warfare, when rapidity of treatment is almost, if not more so at times, as important as the efficiency with which it is carried out, the time lost in surmounting the above difficulties, points 1 and 2 particularly, may imperil the lives of both squad and patient. In addition the necessity under modern war conditions of carrying out most first aid manœuvres in total darkness renders imperative the use of methods which are simple and can be applied effectively and rapidly by the sense of touch alone. In my opinion, the clove-hitch does not satisfy these conditions and I have therefore adopted the following alternative method :

Stage 1.—Manual extension applied in the orthodox way by No. 2 bearer.

Stage 2.—Standing on the same side as the injured limb place a narrow fold bandage around the instep of the boot and draw both ends up close to

the leg making sure that the inner one is at least a foot longer than the outer. Hold both ends taut with the right hand (fig. 1).

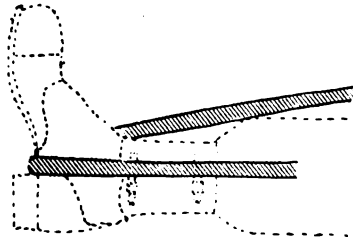


FIG. 1.

Stage 3.—With the left hand lightly grip the patient's ankle between thumb (outside) and fingers (inside) including the bandage in the grip and so anchoring it (fig. 2).

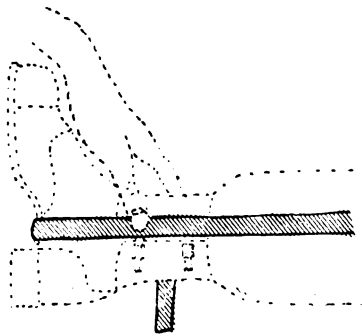


FIG. 2.

Stage 4.—The loose inner end of the bandage is then passed posteriorly round the ankle and brought up so as to encircle it and include the outer end of the bandage which is anchored by the thumb of the left hand. It is then passed over the anterior aspect of the ankle and back to its point of origin under the fingers of the left hand on the inner side of the ankle (fig. 3).

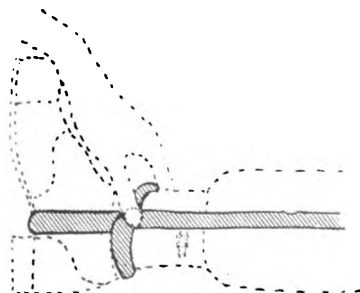


FIG. 3.

Stage 5.—Pass this end over and then under the right-angled loop formed under the anchoring fingers.

Stage 6.—Release the anchoring left hand and grasping both ends of the bandage pull downwards beyond the sole of the boot. These ends may now be fixed to the foot of the Thomas splint and a Spanish windlass applied in the same way as with the clove-hitch (fig. 4).

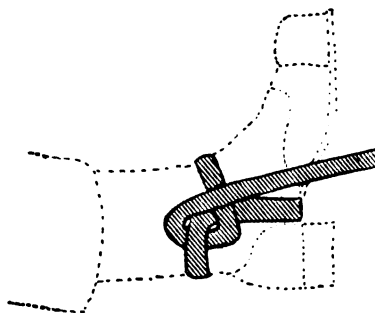


FIG. 4.

I lay no claim to originality in the formation of this "knot" as I am sure it must be a well-known one. I do, however, claim the following advantages over the clove-hitch :

(1) Rapidity of formation—from start to finish, no more than ten to twenty seconds need be spent on it.

(2) It abolishes any need for No. 2 bearer to release his grip at all until the ends are secured to the bottom of the splint, thus avoiding jarring of the fractured bone and resulting discomfort to the patient.

(3) The length of material required for its formation is far less than the 9 feet recommended for the formation of the clove-hitch—the usual narrow-fold bandage is sufficient.

(4) It is far easier to perform in the dark than is the clove-hitch method.

A DEVICE FOR RAISING INJURED LIMBS WHILST CASUALTIES ARE REMOVED ON STRETCHERS.

BY CAPTAIN F. GORDON CAWSTON, M.D.CANTAB.,
S.A.M.C. (Retired).

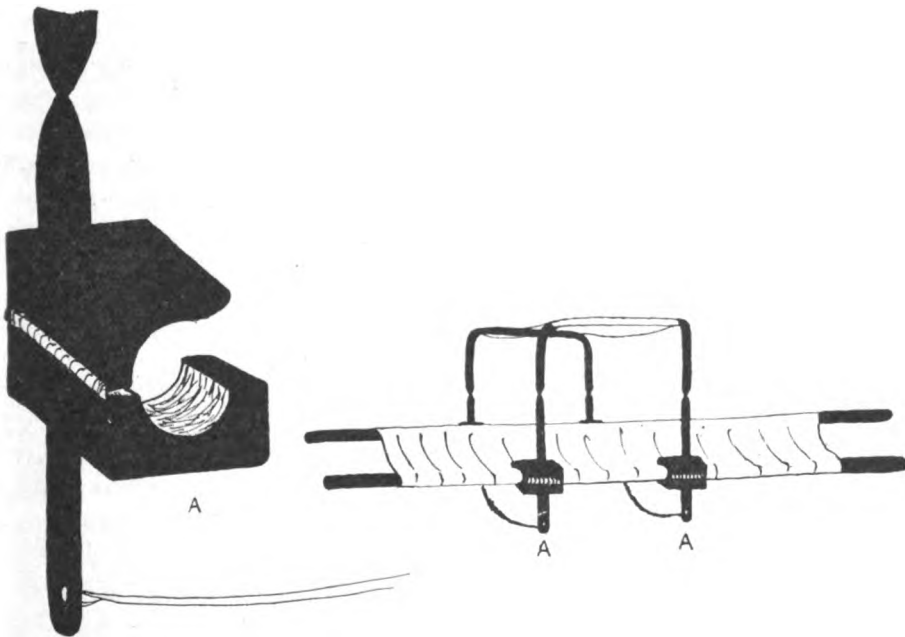
ALTHOUGH knowledge of useful pressure points to control hæmorrhage is rightly demanded of first-aid candidates there would seem to have been too much prominence given to the use of tourniquets judging from the answers given by even the youngest pupils of first-aid.

In a limited experience of surgical procedure I have seldom encountered a case of severe hæmorrhage which could not have been adequately controlled without a tourniquet and on two occasions of amputation was surprised to find that a tourniquet I had in readiness was not required.

If undue swelling of a limb to which a tourniquet has been applied is to be avoided, that limb must be raised and kept cool. Excessive use of lint may obscure the amount of bleeding which is taking place under bandages whilst undue warmth and swelling is encouraged unless the limb is raised.

To obviate the necessity for pillows, which tend to get soiled and shift out-of-place, canvas cross-bands have been suggested for raising an injured limb whilst a casualty is being conveyed on a hand-stretcher, but some difficulty has been experienced in producing a device applicable to all types.

A serviceable arrangement for the usual two-inch by one and a half inch stretcher-rods is considered unsuitable for military stretchers in common use whilst some special adaption is required where the stretcher-rods are of metal, as used in the Far East and as seen at Ambulance Stations.



The accompanying illustration is that of a device for fitting to the side of a round stretcher-rod and holding the ends of canvas-bands for supporting especially a lower limb, tilting of the rods being controlled by a pair of straining straps passed below the canvas on which a casualty rests.

The canvas support need be only about a foot in breadth, its size being exaggerated in the diagram. The device may be applied to any portion of the stretcher-rod without injuring the canvas or weakening the structure.

REFERENCE.

- CAWSTON, F. G. (1940). "A Suggested Means for the Control and Comfort of Injured Limbs during Transport by Hand-stretchers," *Journ. Trop. Med. & Hyg.*, XLIII, No. 14. July 15.

Current Literature.

CHUMAKOV, M. P., and SEITLENOK, N. A. **Tick-borne Human Encephalitis in the European Part of USSR and Siberia.** *Science.* 1940, Sept. 20, v. 92, 263-4.

The authors recall that in recent years a new virus disease of the central nervous system, the verno-aestival or tick-borne encephalitis, has been discovered in the Far East of the USSR. The disease is carried by ticks of the genus *Ixodes* and is endemic in certain woody localities. The virus closely resembles those of St. Louis and Japanese encephalitis except in antigenic structure and in certain other peculiarities.

The authors now record their finding of the disease beyond the woodland zone and their discovery that the sera of patients diagnosed as suffering from the diseases known as "atypical poliomyelitis," "serous meningitis," "post-grip encephalitis," etc., neutralize the virus of the tick-borne encephalitis of the Far East. The disease is acute, with fever and flaccid paralysis; the season of incidence is May to September and persons affected are frequently those whose work takes them into the forest areas where they are attacked by the tick *Ixodes persulcatus*.

Four strains of virus were isolated from man, over twenty from ticks, and four from the brains of wild rodents. All strains were examined by cross neutralization tests and cross vaccination of mice, and were found to be identical with the tick-borne encephalitis of the Far East. In the ticks the virus is transmitted through the ovum and during metamorphosis; it is apparently harmless to them. Further study of geographical distribution and relation to other tick-borne virus diseases is necessary.

C. W.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 2.

DAHLSTROM, A. W. **The Instability of the Tuberculin Reaction. Observations on Dispensary Patients with Special Reference to the Existence of Demonstrable Tuberculous Lesions and the Degree of Exposure to Tubercle Bacilli.** *Amer. Rev. Tuberculosis.* 1940, v. 42, 471-87, 3 figs.

The author has studied 3,919 persons who remained under observation for at least five years. Of these 2,490 were positive to tuberculin, and the majority remained so, but 276 (11.1 per cent) became tuberculin-negative either transitorily or for the duration of the study. It was found that the chance of reversal from positive to negative was least: (1) In those in whom the original reaction was intense; (2) in those who were in continuous contact with infective patients, though if contact was broken the proportion

who reverted to negative was higher, and in families in which there was no history of contact the proportion of those who reverted to negative was as high as 24 per cent ; (3) in those with active reinfection type of tuberculosis, though some persons with calcified primary lesions became negative. So far as race is concerned the results were not very marked, but it appeared that Italians had less tendency than Negroes to react strongly and were much more likely to lose sensitivity. Children were more likely to lose sensitivity than adults ; thus, in children 35.1 per cent lost sensitivity between the ages of 10 and 14, whereas of persons over 20 only 4.7 per cent did so.

These findings are important in that they indicate that the proportion of positive reactors in a community is not an accurate index of the amount of infection which has occurred, and that the persistence of a positive reaction may to some extent depend upon the occurrence of reinfection.

Reprinted from " Bulletin of Hygiene," Vol. 16, No. 2.

LOGAN, J. O., and SAVELL, W. L. **Calcium Hypochlorite in Water Purification.** *J. Amer. Water Works Ass.* 1940, v. 32, 1517-27.

After outlining the history of chlorination in America and commenting on the fluctuating popularity of bleach and of liquid chlorine as water sterilants, the author describes modern calcium hypochlorite.

The substance must not be confused with chloride of lime, nor is it in any sense an improved chloride of lime. The two compounds differ completely in mode of production and properties. Whereas chloride of lime is of variable composition and unstable, modern calcium hypochlorite is of constant composition and is very stable; during storage at 86° F. for a year, the loss of available chlorine was only 10 per cent.

Modern calcium hypochlorite is a dry, white, almost dustless granular material weighing about 45 pounds per cubic foot. The available chlorine amounts to 70 per cent which is twice as much chlorine per unit of gross weight as that carried by a cylinder of liquid chlorine.

Another important property is its high oxidation potential. The reaction is spontaneous with many organic substances such as turpentine, sugars, oils, fats, etc., and care should be taken to see that all tools and utensils used in handling it are clean and free from such substances.

Whilst it is improbable that calcium hypochlorite will supersede liquid chlorine as the main sterilizing agent in large supplies, it is very useful for small installations and for jobs of disinfection connected with the water purification system, such as disinfecting of reservoirs, settling basins, mixing equipment and pipe lines in the distribution system.

An emergency stock of hypochlorite on hand in a municipal plant may provide a practical means of solving a breach in the main chlorination [such as that caused by bomb damage] or when there is a sudden extra demand for water for fire-fighting purposes.

E. WINDLE TAYLOR.

Reprinted from " Bulletin of Hygiene," Vol. 16, No. 2.

Reviews.

MODERN TREATMENT IN GENERAL PRACTICE YEAR BOOK, 1941. Edited by Cecil P. G. Wakeley, *C.B.*, *D.Sc.*, *F.R.C.S.* London : Baillière, Tindall, and Cox, 1941. Pp. xxv + 326. 24 plates, 33 illus. Forty-three articles. Price 12s. 6d.

The above volume is a collection of short papers on treatment reprinted from the *Medical Press and Circular*. The first thirty-one articles deal with various diseases of civilian life. They are contributed by well-known authors and will be found on the whole informative and of general interest to practitioners. The concluding twelve articles deal with War Medicine and Surgery. They vary a good deal in quality and no attempt is made to cover the whole field. War wounds of the fingers are dealt with by Surgeon Commander J. B. Oldham in an article of out-standing excellence which might well be read by all surgeons. Wounds of the upper thigh and buttock are treated in a less fortunate manner and become a catalogue of operations which will be of little use to the perplexed medical officer. Also there must surely be gross errors of description in the accompanying illustrative case. Burns, considering the difficulties under which any author on this subject now labours, are adequately treated apart from an unfortunate substitution of days for hours in the description of secondary shock.

D. S. P. W.

Major J. J. R. Duthie, *R.A.M.C.*, sends us the following impression of "The Medical Aspects of Boxing," by Ernst Jokl, *M.D.* Pretoria : J. L. van Schaik, Ltd. 1941. Pp. 251.

"Dr. Jokl has made a genuine and well-documented attempt to indicate the dangers inherent in boxing both as a profession and as a sport. He has approached the subject from a scientific point of view and has presented his case in a most able manner. I personally agree with a great deal of what he says especially in relation to professional boxing. I must confess that, in my own experience, I have never seen serious injury result from amateur boxing as practised in the Scottish Universities although the possibility is always present as in any strenuous sport. Dr. Jokl denies that there is any proof that boxing cultivates desirable qualities and here I do thoroughly disagree with him. I think boxing, under proper control, breeds courage, endurance, speed, agility, and self-confidence. With a competent referee and judges in charge, I am convinced that, although the danger of serious injury cannot be eliminated, it can be reduced to a negligible risk and that boxing, under Army rules, is an exercise of great value in cultivating those qualities of courage and endurance which are essential to the soldier

on active service. One must face realities and it is obvious that when a man dons uniform he automatically exposes himself to the risk of serious injury or death. Any sport, therefore, which will cultivate in him those qualities which will stand him in good stead in conditions of war must be of great value even though there is some inherent risk in the sport itself. With regard to boxing in schools and colleges where supervision, both lay and medical, may be inefficient, and where the age of the contestants renders them more liable to injury, I am inclined to agree with Dr. Jokl that boxing should be discouraged. I also agree with him that boxing is not a suitable sport for flying personnel in the Air Force where the effects of even relatively mild concussion may lower efficiency temporarily and lead to serious results.

"Boxers should, I think, be carefully examined by an experienced doctor both before and *after* a fight in order to obviate the risk of a man who has sustained some injury, the effects of which are not immediately obvious, departing without medical examination.

"I have read Dr. Jokl's book with great interest and find it a most praiseworthy attempt to investigate the medical aspect of a popular sport. Much remains to be done by the medical profession in this field."

TALKS TO JUNIOR MILITARY MEDICAL OFFICERS, ARMY IN INDIA. By Colonel H. J. Manockjee Cursetjee, *D.S.O.*, M.B., I.M.S., Meerut District Headquarters, Dehra Dun, India. Printed privately.

These "Talks to Junior Officers" have been collected to form an excellent little book which will be of value to all medical officers when first arriving in India, whether they be officers of the R.A.M.C. or I.M.S. There is no reference to duties on active service but the author has very successfully dealt with the ordinary day-to-day duties in Cantonments. Most useful information regarding various I.A.Fs. and books of regulations is given in the Appendices.

THE ACTION OF MUSCLES, INCLUDING MUSCLE REST AND MUSCLE RE-EDUCATION. By Sir Colin MacKenzie, M.D., F.R.C.S., F.R.S.Edin. Reprinted from the Second Edition. Biographical Note by C. V. MacKay, M.D.Melb., F.R.A.C.P. London: H. K. Lewis & Co., Ltd. 1940. Pp. xxiv + 288; 100 Illustrations with Portrait. Demy 8vo. Price 12s. 6d. net.

Sir Colin MacKenzie, Professor of Comparative Anatomy and Director of the Australian Institute of Anatomy, Canberra, died in 1938. A successful career as an orthopædic surgeon specializing in the deformities following upon paralyses and a hobby of comparative anatomy, which later became his absorbing interest, gave him a unique knowledge and perspective of muscle action.

The first edition of the "Action of Muscles" appeared in 1918. The

present issue is a reprint of the second edition published in 1930 and contains a memoir by his cousin Dr. Charles MacKay, who during the author's lifetime acted as his close friend and collaborator. Sir Colin MacKenzie was a great individualist and this volume is no mere compendium of collective knowledge but embodies the results of a lifetime's observation and meditation on muscle action. Such a work cannot be brought up to date by another mind and Dr. MacKay must be congratulated on leaving the text unaltered. Whilst some of MacKenzie's principles of muscle action may not be clear or acceptable to the reader, the section of the book dealing with the specific action of individual muscles will perhaps disturb many preconceptions and is a refreshing counterblast to the traditional descriptions in many anatomical textbooks. "Function of muscle, the all-important factor," he has written, "cannot be satisfactorily taught in the dissecting room. It can only be taught in the living and is largely a question of comparison between the normal and paralytic. Only on this plan can the question of the origin and insertion of a muscle have more than an academic or rather examination interest for students." Whether we believe in MacKenzie's theories or not there can be no gainsaying that his methods of muscle re-education have been crowned with success. Influenced at an early age by the principles of muscle rest and recovery enunciated by Sir Robert Jones, MacKenzie developed these ideas and, not being content to wait until relaxation by itself produced recovery, he evolved his theories relating to muscle re-education. His methods of testing for muscle action, the idea of the minimal load, the zero position for recovery, and the use of the smooth powdered surface of cardboard for re-education muscle work were his own original advances. A plea for the use of intelligence in muscle re-education was the kernel of his teaching. "An ounce of scientifically directed volitional effort is worth pounds of passive treatment. With this in mind it is wonderful what can be accomplished in a warm room with the aid of a table, a few pillows, and a sheet of powdered cardboard."

The stream of orthopædic casualties from the Western Front stimulated MacKenzie to produce this work. The present is unfortunately a most opportune moment for its republication and it is recommended to all young surgeons.

D. S. P. W.



Authors are alone responsible for the statements
made and the opinions expressed in their papers.

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Original Communications.

CLINICAL OBSERVATIONS ON SANDFLY FEVER IN THE PESHAWAR DISTRICT.

BY MAJOR W. M. E. ANDERSON, M.B., B.CH.

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SANDFLY fever is an acute fever of short duration and no mortality caused by a specific virus which is transmitted by the bites of the sandfly *P. papatasi*.

The disease occurs in tropical and sub-tropical countries, notably the Mediterranean area, Northern India and parts of America, under various names, e.g. "Papatasii fever," "Three-day Fever," "Mediterranean Dengue," "Summer Influenza," etc. An account of the disease was recorded in 1803 by Pym (as quoted by Rogers and Megaw, 1939) and cases which were probably the first recorded in India were reported at Mian Mir by James (1903). It has frequently been confused with dengue, which it resembles, but it is now known that the two diseases are distinct conditions and are caused by different viruses transmitted by different vectors.

P. papatasi was demonstrated as the vector of the disease by Doerr, *et al.* (1909), who found that the fever could be produced in places where it was hitherto unknown by the bites of sandflies which had been fed on persons suffering from the disease in Dalmatia. Shortt, *et al.* (1934, 1935), confirmed this and were able to produce the disease in volunteers in a non-sandfly area (Kasauli) by the bites of sandflies which had previously been fed on patients suffering from the fever in Peshawar.

In the North-west Frontier Province and, to a lesser extent, in the Punjab

sandfly fever presents a problem of considerable military importance by reason of the large number of cases, amounting to an epidemic, which occurs each year among the British garrison. The military medical authorities in these regions have devoted much attention to the eradication of sandflies from barrack areas and, as a result of systematic preventive measures over a number of years, the incidence of the disease has been appreciably reduced. Many cases, however, still occur and it would appear that one of the chief difficulties of a final solution of the problem is that of diagnosis. The diagnosis of sandfly fever is by no means easy and may, sometimes, be extremely difficult. There is no generally available specific laboratory test and diagnosis can, as yet, only be reached through a proper interpretation of clinical observations. The traditional account is of a short sharp fever characterized by headache, photophobia, lumbar myalgia, flushing of the face, conjunctival suffusion, bradycardia, and leucopenia and, while a proportion of cases conform to this description and can be recognized at an early stage, cases of milder type also occur in which diagnosis is less easy. In addition there are, each year, many cases of short indeterminate fever which, in some respects, resemble sandfly fever and of which some, at least, are diagnosed as sandfly fever either as a result of incomplete examination or simply for want of a better diagnosis. Statistics which include these "sandfly-like" fevers but do not take account of undiagnosed mild but authentic cases must necessarily be inaccurate and a realization of this fact is essential if sandfly prevention is to be put on a satisfactory basis. Many anti-sandfly measures are still in an experimental stage and their efficacy can only be assessed by reference to statistics which reveal a decrease or otherwise in the incidence of the fever. Accurate statistics can only be produced by accurate diagnosis and, in an attempt to assist in this, observations on a number of proved cases are recorded here.

Mention has been made of the absence of a generally available laboratory test and, up to a few years ago, routine examinations in military laboratories in India yielded little positive information but the successful culture, on chorio-allantoic membrane, of the virus of the fever by Shortt, *et al.*, gave promise of more definite results. During the hot weather periods of 1938 and 1939, as portion of the work of an "Enquiry into Sandfly" fever under the auspices of the Indian Research Fund Association, specimens of serum were obtained from 133 patients in the wards of the British Military Hospital, Peshawar. In all these cases, from the history of onset and condition on admission, sandfly fever was considered a possible diagnosis at the outset and they form a fairly representative collection of typical and mild cases of the fever together with a number of cases of "sandfly-like" fevers. They do not, by any means, include all such cases who were admitted over the period as the personnel of the Enquiry was limited and other portions of the work made it impossible to visit the wards daily.

The number of specimens collected from each patient during the acute stage varied from one to five and they were, as a rule, collected at bi-daily

intervals commencing, when possible, on the day of onset although the shortage of personnel already mentioned sometimes prevented this. Further specimens were collected after the patient's discharge from hospital and investigated for the presence of virus. Reference will be made to the findings at a later stage.

A portion of each serum was dried and sent to the King Institute of Preventive Medicine, Guindy, Madras (the Headquarters of the Enquiry), where it was re-emulsified and inoculated on egg-membrane. The majority of the sera were also inoculated in like manner in Peshawar and, from the combined results, the 133 cases were classified as below, on a basis of whether or not lesions were produced typical of the virus of sandfly fever :

I. Positive (typical lesions)	..	..	..	..	78
II. Doubtful (lesions small in size and few in number)					14
III. Negative (no lesions produced)	..	..	..	..	40
Serum contaminated	..	..	..	..	1

Working conditions made it necessary for these sera to be stored in the refrigerator, in some cases for several weeks, before inoculation and the specimens sent to Guindy had to undergo desiccation followed by five days in the post at the hottest time of the year. It is believed that some of the cases in the "doubtful" and "negative" groups were probably true sandfly fever where the virus had failed to remain viable under these rather severe conditions but, as this must remain hypothetical, the observations on these patients are not included in the notes which follow.

For each patient records were made of clinical findings together with temperature and pulse readings. It was not possible to carry out more than a routine physical examination and, for such matters as blood counts and urine examinations, the information, when available, was procured from laboratory and clinical side room reports.

The notes of the 78 "positive cases" are summarized below and observations are also included on five volunteers in whom the fever was artificially induced by inoculation with infective serum during trials of a sandfly fever virus vaccine at the Pasteur Institute, Kasauli, in July and August 1938 (Shortt, *et al.*, 1940).

From the clinical viewpoint, attacks of the disease varied so considerably in intensity that it appears desirable to divide the cases into two types for which the names "severe" and "mild" are suggested. Some hesitation is felt in putting forward additions to the nomenclature but it is believed that this division will justify itself by emphasizing the fact, sometimes not clearly grasped, that the fever occurs in both very severe and also exceptionally mild forms. Of the 78 cases, 29 have been grouped as "severe" and 49 as "mild."

The ætiology, pathology and onset are common to both types and will be described together but separate descriptions will be given of the clinical features.

.ETIOLOGY.

All cases occurred during the hot weather period commencing early in April and continuing until the last week of October. During the two years of the Enquiry, adult forms of *P. papatasi* were found in Peshawar from the first two weeks of March up to mid-November, so that the seasonal incidence of the disease coincides with that of the vector. Both severe and mild cases occurred throughout the season. Tabular records of the number of cases over the two years showed a progressive rise up to the early part of July after which there was a steady decline until mid-September, followed by a small secondary rise over the next six weeks. It is just possible that this secondary rise may be connected with the return from hill stations to the plains of numbers of troops and families who are not well versed in the various protective measures.

Seventy-two of the patients were men between 20 and 30 years and six between 31 and 38 but this is unimportant as the ages of most British troops in Peshawar fall within these limits. Investigation of the length of service in India showed that 30 patients (40 per cent) were in their first year, 58 (74 per cent) in their first two years, and 78 (86 per cent) in the first three. Of the remaining 10 cases, 5 were spending their first hot weather in a "sandfly area" (as defined by Rogers and Megaw, 1939). Four others gave a history of at least one similar attack in the past, which may or may not have been sandfly fever, and the remaining patient was a man of three and a half years Indian service who had, somewhat paradoxically, spent the previous hot weather at Landi Kotal in the Khyber Pass, a recognized hot-bed of the fever. The general trend of the evidence suggested that the fever is most likely to occur among comparatively new arrivals and, in this series, 80 per cent of cases were men with less than two years' service in a part of India where sandfly fever is endemic. There was no evidence that new arrivals are more liable to contract the disease in its severe form.

PATHOLOGY.

As there were no fatal cases, no information was forthcoming regarding the morbid anatomy. The clinical evidence rather suggested that the tissues most affected by the virus are those of ectodermal and, to a somewhat lesser extent, of mesodermal origin, while tissues developed from the entodermal layer appear to be only slightly affected. The evidence on this point requires considerable amplification.

INCUBATION PERIOD.

Among the five artificially infected volunteers the days of onset were as follows: two on the sixth day and one on each of the seventh, eighth and tenth days. This incubation period is rather longer than that mentioned in many textbooks.

ONSET.

In about 50 per cent of cases there was a short, rather vague premonitory period during which the patient felt slightly "off-colour," with lassitude, loss of appetite and slight muscular discomfort; four patients complained of nausea and two of mild vomiting. This premonitory period was completely absent in other cases but, when present, lasted for one to two days and was succeeded by the true initial phase, consisting of severe frontal headache accompanied by very marked malaise. About 75 per cent of patients stated that they first felt really ill on waking in the morning or after the afternoon siesta; a few reported the onset of symptoms shortly after strenuous exercise such as a game of football or hockey. In about 30 per cent of cases the first complaint was a feeling of chilliness but in none was there a history of a true rigor. Sweating was not an early symptom but this feeling of chill frequently induced the patient to put on an extra blanket or a woollen garment which sometimes produced sweating. As the headache became more severe its intensity drew the patient's attention from his other symptoms so that, in almost every case, he reported sick with "severe headache," a matter of no little importance in distinguishing the disease from other febrile conditions in which the first complaint is of "general malaise" (or words to that effect!). The onset was usually fairly rapid and in most cases the symptoms were well marked within two to three hours of the commencement of the true initial phase.

CLINICAL FEATURES. THE SEVERE TYPE.

The cases in this group conformed in most ways to the textbook description and the symptoms were well marked, enabling diagnosis to be reached without undue hesitation. It was found that patients did not always display every symptom and, at times, the diagnosis was made in the absence of some or other feature normally associated with the fever. As will be seen, this gap in the evidence was usually compensated by an accentuation of other symptoms, e.g. in cases where backache was slight or absent, the "eye-signs" were well marked, etc.

Symptoms.

The essential symptoms of the disease appeared to be headache, malaise, pain behind the eyes, backache and myalgia.

Headache was present in all twenty-nine cases and was most prominent in the lower frontal and supraorbital regions. In four cases it also involved the occipital region, and in one, the apex. This was possibly due to some extraneous factor such as eyestrain or was of intestinal origin (three of these five patients complained of mild abdominal symptoms). The typical "sandfly headache" appears to be "low frontal, extending into the orbits." This headache was very severe and frequently caused insomnia.

Malaise was always present and very severe. In the early stages patients

felt extremely ill and became mentally dulled with little or no interest in the outside world. In this stuporose state it was sometimes a matter of no little difficulty to extract an account of the symptoms.

Pain behind the eyes, in addition to the headache, was present in twenty-eight cases and *photophobia* in twenty-one. When these were absent the headache tended to involve the frontal rather than the supraorbital region.

Backache was present in all but two cases (in both of whom the headache was well marked) and in ten was very severe. It was usually described as being in "the small of the back," i.e. the lower lumbar or lumbo-sacral regions.

Myalgia was usually present. In sixteen cases it was most marked in the muscles of the thighs and calves. In two of them, it was also present in the arms and shoulders. In four cases the upper extremity muscles were most affected and in four the myalgia was general. In two cases it was absent in both of whom the "eye-signs" were well marked. As a rule active movements of the affected muscles were painful.

There was some evidence that the myalgia may also be present in the orbital muscles, as shown by pain or discomfort on moving the eyes. Out of fourteen cases this was present in eleven in eight of whom the pain was experienced during movement and in three at the end of the movement. Movements of each muscle were carried out in turn and there was no evidence of any particular muscle or nerve being specially affected. This phenomenon was particularly obvious in patients with severe orbital headache and pain behind the eyes and who complained of severe myalgia in other regions. It was not seen in cases where there was no myalgia elsewhere.

Certain other symptoms were noted but are considered of less diagnostic importance:

Sore throat was present in mild degree in three cases and consisted of little more than a feeling of dryness on swallowing.

Joint pains were frequently mentioned by the patient but further questioning elicited that the pain was really in the muscles about the joint. Only one patient had a true arthralgia which was referred to the knees.

Pains in the chest were reported in one case in whom bronchitis was also present.

Abdominal symptoms of mild type were encountered in the early stages of fifteen cases, i.e. two of vomiting, six of nausea, five of constipation, one of vomiting and nausea and one of nausea and constipation. These were never severe and resembled the intestinal upsets which accompany the onset of other acute fevers. Actual abdominal pains (also mild in type) were present in two cases, in one associated with nausea and in the other with constipation, and consisted of rather vague pains in the upper part of the abdomen. There was always a disinclination for food when the temperature was raised. No other evidence was forthcoming that intestinal disorders are an essential feature of sandfly fever.

Physical Signs.

Severe cases of sandfly fever presented a very typical picture. The patient's face was flushed, conjunctival vessels very suffused and the skin hot and dry to the touch. He usually lay slightly on one side with head turned away from the light and a hand shading his eyes. When the disease becomes established the patient looks, and is, extremely ill.

The *skin* in the first twenty-four hours was hot and dry. Later, with the administration of diaphoretics, it became slightly moist. No rash was observed but a few patients showed spots due to insect bites and there were many cases of "prickly heat."

Flushing of the face was very noticeable, especially in fair-complexioned patients, and involved the forehead, cheeks, front of the neck and sometimes the upper part of the chest and did not blanch on pressure. The affected skin was bright red in colour fading gradually towards the periphery.

Conjunctival suffusion was present in all cases and varied from a general redness to a well-defined injection of vessels. In nine cases this injection was most marked at the outer canthus, in nine at both canthi, presenting the appearance of a horizontal zone of dilated vessels, and in eleven the suffusion was general. While this is a physical sign of definite confirmatory value it must be borne in mind that such factors as electric fans, dust storms and over-chlorinated swimming baths tend to produce mildly bloodshot eyes in healthy persons during an Indian hot weather.

Rhinitis was present in only one case and was then only mild. There were no cases of *epistaxis* or pronounced *lacrimation*.

The *tongue*, in all cases, was coated with a whitish yellow or whitish brown fur. The last sixteen cases of the series were particularly examined for the presence of a clean red margin at the sides and tip, as described by Phillips (1923), and this was found to be present in fifteen.

Faucial injection, usually well marked, was present in twenty-two cases and is probably of value as a confirmatory sign. There were no cases of cervical adenitis.

Heart and Lungs.—One patient had a slight bronchitis and gave a history of numerous previous attacks. Otherwise there were no cardiac or pulmonary abnormalities.

Muscular Tenderness.—Painful muscles were sometimes tender on palpation. In twenty-seven patients with backache, eleven complained of a little tenderness on pressure over the loins and one particularly mentioned that lying flat on his back increased the pain.

Central Nervous System.—The pupillary reflexes were normal. Abdominal reflexes and knee-jerks tended to be sluggish but were never completely absent.

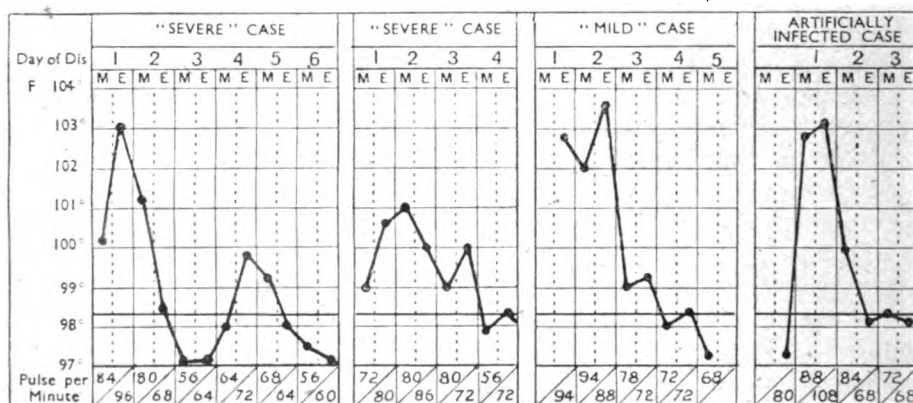
Leucocyte Counts.—Clinical side room reports were forthcoming in seven cases and the mean of the results was as follows: Total white cells 3,300. Polymorphonuclears 56 per cent; lymphocytes 24 per cent; large mononuclears 16 per cent; eosinophils 3.7 per cent; basophils 0.3 per cent.

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This agrees with the finding of McCarrison (1907), in his cases in Chitral, of a leucopenia with a relative decrease in polymorphs and an increase in large mononuclears.

The urine was examined in thirteen cases of which one showed a "trace" of albumin on the first day of fever. This was absent on subsequent days.

Temperature and Pulse.—In cases seen very soon after the onset, the temperature was sometimes only slightly above normal but rose very rapidly, sometimes by as much as 4° F. in a few hours. The duration of fever was as follows: two days 6 cases; three days 16 cases; four days 4 cases; five days 3 cases. There was a definite tendency for the fever to be more prolonged when the patient delayed reporting sick for twenty-four hours or more after the onset. A secondary rise in temperature, defined as a rise to more than 99° F. occurring at least twenty-four hours after the original return to normal, was noted in three cases and lasted twenty-four hours. The maximum temperature reached varied from 101·0° to 104·8° F. with a mean of 102·6° F.



Sandfly Fever Temperature Charts.

The pulse is a very important diagnostic feature and in all cases was comparatively slow and full. To emphasize the presence of this relative bradycardia every pulse reading recorded on the charts has been set out in tabular form against the corresponding bi-daily temperature reading on the successive days of the fever (Table I).

In this table, to economize space when two or more pulse readings corresponding to a particular temperature are identical the figures are not repeated but, to indicate the general tendency, the figure nearest the mean is printed in heavier type.

This table includes both severe and mild cases as there was no noticeable difference in the pulse charts of the two groups. The pulse-rate of each patient was noted as part of the physical examination but the majority of

TABLE I.

PULSE RECORDS CORRESPONDING TO TEMPERATURE READINGS THROUGHOUT FEVER. THE FIGURE NEAREST TO THE MEAN IS SHOWN IN HEAVIER TYPE.

Temperature in °F.	Day 1		Day 2		Day 3		Day 4		Day 5	
	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.	a.m.	p.m.
104.2—105	—	—	—	104 108 112	104	—	—	—	—	—
103.2—104	88 94 100	96	90 92	86 88 98	—	100 110	88 92	—	—	—
102.2—103	72 80 92 100	72 90 80 92 84 94 96	88 90 96 98 104	80 90 92 94 98	72 80 84 94 96	82 —	—	—	—	—
101.2—102	96 98	90 96	80 90 94 96	80 84 90 96	72 86 80 92 84 96 100	80 86 92	88 92	84 —	—	—
100.2—101	76 84	72 80 84 88 92	70 88 72 90 80 86	68 78 80 82 86	72 80 82 88 98	72 76 80 82	86	84	88	—
99.2—100	76 82 86	72 78 80	68 86 78 88 82 90 84	68 84 70 86 76 80	70 74 78 80	60 84 64 94 72 80	58 64 68 76 80	64 68 72 76	72 80	72 76
98.4—99	68 72	60 64	66	62 64 72 80	60 78 64 80 68 82 70 72	56 74 60 76 64 80 68 70 70	60 72 64 78 68 80 70 68	56 72 60 74 64 80 68	64 68	60 64 68

the figures in this table were recorded by the hospital staff and their absolute accuracy cannot be guaranteed. They show, however, quite clearly that, even at the height of the fever, the pulse is slow in relation to the temperature.

In nine cases, two severe and seven mild, the basal metabolic rate was calculated from Dale's formula and the results varied from +16 per cent to +46 per cent. It is doubtful if this observation is of any practical value.

Of the five experimentally inoculated volunteers (Indians) two developed the severe type of fever. Their incubation periods were six and seven days respectively, the onset was fairly rapid, within a few hours of the patient first feeling ill, and was accompanied by headache and lassitude. With the commencement of the fever there was intense headache in the lower frontal and supraorbital region and photophobia was very marked. There was severe malaise and myalgia, especially of the thighs, the conjunctivæ were very suffused and the tongue was coated. The chest and abdomen were

negative and there were no enlargements of the liver and spleen. The attacks of fever lasted two and four days and the maximum temperatures reached were 102·4° F. and 102·6° F. respectively, with relatively slow and full pulse. Neither of these patients showed a secondary rise of temperature.

Summary.

The clinical features of the severe type may be summarized as follows : a fever of acute onset lasting two to five days and characterized by frontal and supraorbital headache, pain behind the eyes, frequently photophobia, backache, myalgia chiefly in the legs and often in the orbital muscles, flushing of the face, conjunctival suffusion often most marked towards the canthi, coating of the tongue, usually with a red margin, injection of the fauces, leucopenia and relative bradycardia.

THE MILD TYPE.

As stated above there were forty-nine patients in the "mild" group, consisting of cases in which the fever was milder than in the "severe" group and, in consequence, the clinical picture was less definite and some of the features traditionally associated with the disease were absent. As the distinction between mild and severe cases is only one of degree it will be sufficient to refer briefly to the more important symptoms and signs and the frequency with which they occurred.

Headache was present in all cases and was exceptionally severe in 9. It occurred in the low frontal and supraorbital regions, usually in both, and in 5 cases was also present in the occipital region. Malaise was always present but in less degree than in the severe type. Pain behind the eyes was present in 38 cases and photophobia in 14. Twenty-seven patients had backache and 31 myalgia; in 24 of these the thighs and calves were chiefly affected and in 6 the myalgia was general. Ten patients complained of mild sore throat and one of mild discomfort in the upper abdomen.

The physical appearance of these patients varied considerably but, on admission, the majority looked definitely ill. Flushing of the face was present in 40 cases and the hot dry skin was rather less marked than in the severe group. Conjunctival suffusion occurred in all 49 patients; in 19 it was general, in 13 the outer canthus was chiefly affected and 17 showed the "zone" of injected vessels. Pain on moving the eyes was tested for in 18 cases and was present in 6, all of whom had myalgia in other muscles. There was one case of rhinitis. The tongue was coated in 44 cases and, out of 25 specially examined, the clean red margin was present in 16. Faucial injection occurred in 39 cases. No abnormalities of the chest were found. In 2 cases there was tenderness of the upper abdomen. Out of 25 patients with backache 16 complained of pain on pressure over the back. As in the severe group, the reaction to light was normal and the superficial and deep reflexes were slack.

Reports of white cell counts were only available in three cases and the

figures agreed with those already noted. The urine was examined in 16 cases and found to be normal.

The duration of the fever was as follows: one day 2 cases; two days 18; three days 18; four days 11; The maximum temperature reached varied from 100° to 104° F. Six showed a secondary rise of temperature to the region of 99·5° to 100° F., lasting for twelve to twenty-four hours. The pulse-rate was relatively slow. Although the fever was, on the average, slightly shorter and the maximum temperature slightly lower than in the severe group there was no evidence of a direct ratio between these factors and the severity of the attack.

In many of the mild cases some of the features described as typical of the severe form were absent but there was, almost always, sufficient evidence to form a diagnosis. For example, in eleven cases where backache and myalgia were both absent, this was offset by the presence of headache, pain behind the eyes, flushing of the face, conjunctival suffusion and coating of the tongue. Of the series there was only one case where, on clinical grounds alone, there was reasonable doubt as to the correct diagnosis; the clinical picture was of a patient with low frontal headache, general malaise, conjunctival suffusion and injection of the fauces, with fever of one day's duration, reaching 100·8° F., and a pulse-rate which did not exceed 76.

Three of the artificially inoculated volunteers developed the mild type of fever with respective incubation periods of six, eight and ten days. The more prominent features were headache, chiefly in the frontal region, malaise, backache, myalgia, chiefly affecting the thighs and conjunctival suffusion. Two patients complained of photophobia. The duration of fever was one, two and three days respectively and the maximum temperatures reached were 100·2°, 102·8° and 99·8° F., for which the corresponding pulse readings were 80, 88 and 80. One of these patients showed a secondary rise of temperature to 99·8° F., coming on twenty-four hours after the original return to normal and lasting twelve hours.

TABLE II.
RELATIVE FREQUENCY OF OCCURRENCE OF VARIOUS SIGNS AND SYMPTOMS.

Symptoms	Percentage occurrence in	
	Severe cases	Mild cases
Headache	100%	100%
Malaise	100%	100%
Pain behind eyes	96%	77%
Photophobia	70%	28%
Backache	92%	55%
Myalgia	92%	63%
<i>Physical Signs</i>		
Hot dry skins	100%	100%
Flushing of face	100%	81%
Conjunctival suffusion	100%	100%
Pain on moving eyes	80%	33%
Coated tongue with clean red margin	94%	64%
Faucial injection	73%	80%
Bradycardia	100%	100%

It is impossible to give a concise summary of the clinical features of the mild type which will cover even the majority of patients but the comparative frequency with which the more important symptoms and signs occurred in the cases in the two groups is shown in tabular form (Table II).

Too much emphasis cannot be laid on the necessity for very thorough physical examination and, in cases where sandfly fever appears at all likely to be present, particular attention should be paid to the clinical features described. Without careful and complete examination diagnosis is, at best, haphazard and unsatisfactory and is bound to result in the production of misleading statistics.

COURSE OF THE DISEASE.

In the cases under review, after admission to hospital and the commencement of treatment, the temperature was under control within twelve to twenty-four hours and subsided by lysis with a gradual abatement of symptoms. A feature of the disease is its lowering physical and mental effects and, while patients were usually fit to get up twenty-four hours or so after the temperature subsided, they invariably felt very weak and it was several days before they were fit to return to barracks. The mental effects also took some time to pass off and depression and even apathy during convalescence were by no means unusual. The practice of sending men who have had sandfly fever to hill stations for a week or longer after discharge from hospital is to be very strongly endorsed.

Specimens of serum were collected during the weeks following the fever and it has been shown (Shortt, *et al.*, 1940) that well defined lesions were produced on egg membrane by a considerable number of sera collected four or five weeks after the date of onset. This would appear to indicate that virus is present in the blood of convalescents for a considerable time after recovery. It has not yet been shown that such convalescents act as reservoirs of infection and can transmit the virus to sandflies but it is for consideration whether they should be subject to some form of isolation such as sleeping in separate buildings and being issued with an extra supply of repellants.

DIFFERENTIAL DIAGNOSIS.

In considering the question of differential diagnosis, reference has been made to the fourteen "doubtful" and forty "negative" cases. All these were patients whose condition on admission gave reason to suppose that sandfly fever might be the diagnosis but, in several cases, further observation and investigation showed that the fever was due to another cause. Thus, there was one case each of benign tertian malaria, pleurisy and tonsillitis, two of bronchitis and one who appeared to be a severe reaction to a "T.A.B." inoculation. Of the remaining 48 cases, after reconsideration of the notes, a tentative diagnosis has been made in all but three. Nineteen patients (seven "doubtful" and twelve "negatives") are considered to have had sandfly fever but for some reason not clearly understood the virus did not

produce definite lesions or failed to remain viable on storage. Four patients who showed a combination of rigor at the onset, generalized pains in muscles and joints, rhinitis, sore throat and bronchial catarrh have been classed as influenza. There were eleven in whom abdominal symptoms, nausea, vomiting and constipation were prominent and who were probably representative of a type of case encountered in considerable numbers every hot weather, mostly among newcomers to the tropics, characterized by short low fever, headache, chiefly in the apex, vague pains all over the body, discomfort, tenderness of the abdomen and sometimes jaundice. This condition is probably caused through inadequate protection of the upper abdomen from the draught of fans and punkahs, combined with unwise eating and drinking and lack of attention to the bowels. Such cases are not infrequently labelled "enteritis" or "copræmic fever." The remaining eleven cases are believed to have been mild cases of "effects of heat." This condition, in its mild forms or, more important, in the early stages of the insidious forms, frequently simulates sandfly fever with severe headache, marked flushing of the face, and conjunctival suffusion, hot dry skin and myalgia of varying degree and nature. In mild "Heat" cases the skeletal reflexes may become abolished, there is usually definite gastric discomfort and the temperature in the rectum is raised by more than 2° F. above that in the mouth. In his mental state, the "Heat" case is often restless and even irritable in contrast to the "sandfly" patient who tends to be drowsy and rather apathetic.

Other conditions which may resemble sandfly fever include the early stages of almost all acute fevers, e.g. the enteric group, the typhus group, dengue, undulant fever and acute septic conditions. Successful differentiation depends on thorough physical examination, careful daily examination and making full use of the laboratory. The most important condition to be distinguished from sandfly fever is "effects of heat" in its insidious forms and the life of the patient may depend on early recognition and prompt treatment.

PROGNOSIS.

Recovery occurred in all cases and a search of the literature has failed to reveal any record of a fatal case. No positive evidence could be obtained of the occurrence of second attacks of the fever either in the same year or in successive years.

TREATMENT.

In all cases, on admission, the bowels were opened with calomel followed by salines and patients were kept in bed on free fluids and with no solid food. The remainder of the treatment was symptomatic, consisting of diaphoretics, such as aspirin, "A.P.C." or salicylates, given four-hourly until the temperature subsided. A few cases where the headache was very severe were given opium in the form of "three fifteens." It was not found possible to investigate the effectiveness of the sulphonamide derivatives.

It is beyond the scope of these notes to consider the question of preventive measures against sandflies.

INTER-RELATIONSHIP OF MILD AND SEVERE TYPES.

Although, as already stated, the division of cases into "severe" and "mild" is considered both justified and desirable, there is no reason to believe that they are caused by strains of different virulence and, in fact, the severity of the attack would appear to depend on the resistance of the patient. This was suggested by the results of some of the experimental inoculation work as shown in Table III.

TABLE III.
CLINICAL EFFECTS OF INOCULATION WITH INFECTIVE SERA.

Pool No.				Containing Sera from patients	Type of Fever in volunteers
II.	..	..	..	2 Severe ..	1 Severe (C).
				1 Mild ..	1 Mild (I). 2 Negative (I, C).
III.	..	..	..	2 Mild ..	1 Severe (C).
				1 Negative ..	1 Mild (I).
IV.	..	..	..	2 Severe ..	1 Mild (I).
				1 Mild ..	3 Negative (C, C, C.)

I = Volunteer previously inoculated with experimental sandfly fever virus vaccine.

C = Uninoculated control.

The volunteers were inoculated from pools, each of which consisted of a mixture of three sera from cases of clinical sandfly fever in Peshawar. The results from pools Nos. III and IV are of most interest as indicating the production of a "severe" case from "mild" case serum, and of a "mild" case from "severe" case serum. Should this observation be confirmed by subsequent work it would appear that individual resistance is the main factor which determines the severity of the attack unless evidence is forthcoming that the virus undergoes some form of variation.

ACKNOWLEDGMENTS.

I have to express my thanks to the Secretary, Governing Body and Scientific Advisory Board, Indian Research Fund Association, for permission to submit this paper for publication. The Enquiry of which this work formed part was the subject of a special grant from the Association over a period of two years. I have also to thank Lieutenant-Colonel H. E. Shortt, *C.I.E.*, *I.M.S.*, Director of the King Institute of Preventive Medicine, Guindy, and Officer-in-charge of the Enquiry, for allowing me to put forward for publication this portion of the work. Thanks are also due to Colonel E. U. Russell, *M.C.*, and Colonel J. Rowe, *M.C.*, during their respective tenures as Officer Commanding, British Military Hospital, Peshawar, for

permission to work in the wards and the Medical Officers and Assistant Surgeons, I.M.D., for their co-operation and interest. /

REFERENCES.

- DOERR, FRANZ and TAUSSIG (1909). "Das Pappataciferber," Leipsic und Wien. Franz Deuticke.
- JAMES, S. P. (1903). Reports of the Malaria Commission of the Royal Society, 1901-2.
- McCARRISON, R. (1907). *Ind. Med. Gaz.*, 1907, p. 7.
- PHILLIPS, L. P. (1923). "Practice of Medicine in the Tropics." Byam and Archibald, Oxf. Med. Publications.
- ROGERS, Sir L., and MEGAW, Sir J. W. D. (1939). "Tropical Diseases." J. and A. Churchill, London.
- SHORTT, H. E., PANDIT, C. G., ANDERSON, W. M. E., and SANJIVA RAO, R. (1940). *Ind. Journ. Med. Res.*, **27**, 4, 847.
- SHORTT, H. E., PANDIT, C. G., and RAO, R. S. (1938). *Ibid.*, **26**, 1, 229.
- SHORTT, H. E., POOLE, L. T., and STEPHENS, E. D. (1934). *Ibid.*, **21**, 4, 775.
- Idem.* (1935). *Ibid.*, **23**, 1, 279.
- SHORTT, H. E., RAO, R. S., and SWAMINATH (1938). *Ibid.*, **26**, 1, 229.
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UREA TREATMENT OF WOUNDS.

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LIKE the ancient alchemists with their unremitting quest for the philosopher's stone surgeons search for a substance which will efficiently destroy pathogenic micro-organisms in the tissues without at the same time having harmful effect on the tissues themselves. While a large number of chemical compounds have been tried as bacteriocides it seems strange that so little effort appears to have been given to explore the feasibility of employing substances which are normally present in the body for this purpose. Symmers (1915) of Belfast investigated the anti-bacterial properties of urea more than twenty-five years ago. He observed that the presence of urea prevented the meningococcus from reducing hæmoglobin. Further laboratory tests showed that urea in certain concentrations killed non-sporing bacteria *in vitro* and that when added to tuberculous sputum it retarded and diminished the growth of pyogenic organisms and in fact rendered some specimens completely sterile. He also found that urea killed bacteria in the presence of blood and albuminous material and very readily destroyed *B. pyocyaneus*. Symmers refers to W. J. Wilson's work in which it was observed that urea in a concentration as low as 1.5 per cent caused cultures of *B. coli* to assume pleomorphic forms. Following the investigations of Symmers, T. S. Kirk (1915) put urea to the practical test of applying it to infected wounds. This he began in 1911 and continued to practise with enthusiasm throughout his surgical career. He found that rapid healing without congestion or irritation of the skin was produced. He claims that he opened up and cleaned out abscess cavities and, after packing them with urea and closing the skin with a continuous suture, he obtained healing by first intention despite the fact that the pus grew organisms which in some cases were gas producing. He first used a saturated solution but found that the application of dry crystalline urea covered by oiled silk to prevent absorption into the dressings gave better results. He found it to be completely without harmful action, having used it in the presence of bone plates, Thiersch grafts and in hernia wounds. Since urea is a stable chemical compound and can be stored for long periods in paper packets Kirk suggested its use as a first-aid dressing under war conditions. Kirk's observations do not appear to have aroused any very great enthusiasm following their publication but the method has been recently revived and it has been found to be extremely useful and has been favourably reported upon by W. Robinson (1936), Holder and McKay (1937), Muldavin and Holtzmann (1938) and the writer (1940).

Indications and Technique.—Urea is an efficient dressing in all infected

wounds and has been employed by me with gratifying results principally in infected traumatic wounds but also in superficial abscesses, carbuncles and suppurating lymphadenitis. The antiseptic power of urea is in direct proportion to its concentration and it should therefore be applied in the pure form and covered with some impervious material such as jaconet, sheet rubber, etc. Muldavin and Holtzmann used waxed paper which is easily made by autoclaving some stout paper in a flat tin with a small piece of hard paraffin. Sheet rubber can be improvised from discarded motor or cycle tubes and may be sterilized by boiling. The dressings are not touched for five days except in the case of trauma with a soiled wound. The excessive discharge of blood and serum in a fresh wound, especially where hæmostasis is not complete, makes it desirable to re-dress the wound in twenty-four hours on account of loss of urea from dilution. The second dressing may be left alone for five days or more. On removing the dressings from a grossly infected wound the appearance is quite remarkable. Fresh healthy granulations are observed which are seen to be bathed in a clear reddish fluid. Pus has been pushed aside and has soaked into the dressings though a little may be found between the skin and jaconet. Sloughs have disappeared unless they were very large to begin with, in which case it is better to excise them. Urea has little or no osmotic effect and is freely diffusible through most animal membranes. Since it passes without hindrance through the envelope of the red blood corpuscle saturated solutions like blood just as readily as distilled water. The reddish colour of the serum bathing the granulations already alluded to is evidently due to the laking of blood escaping in small quantities. After one treatment many wounds can be regarded as virtually clean and further treated according to their size and situation. Large wounds can be skin grafted at once while smaller ones may be washed clean, dried, powdered with boracic acid powder and allowed to heal under a crust.

Abscesses are best treated by incision and thorough cleaning followed by a pack of solid urea. This is followed by healing with very little scarring. I have not employed Kirk's more daring method of evacuating the contents, packing with urea, and immediate suture.

Carbuncles may be treated by boldly excising a large circular block of skin and subjacent sloughy tissue of about half the diameter of the whole carbuncle or a little more. Any sloughs not included are curetted out. Hæmostasis is secured as far as possible and urea is packed in and the dressings are applied as firmly as possible over sheet rubber. This treatment gives the optimum cosmetic result and leaves only a small dimpled scar which is much less conspicuous than the old cruciate incision. This scar if on a conspicuous site can subsequently easily be excised or raised by the insertion of a free fat graft.

Urea treatment can be combined both with chemotherapy and with the closed plaster method. In fact whenever it is used on extremities splinting should be employed to secure immobility. It is not necessary to protect

the surrounding skin with ointments, etc., and none of my cases has complained of pain which could be held to be undoubtedly due to the urea.

ILLUSTRATIVE CASES.

Case 1.—A child aged 4 had the left leg torn in some machinery. Most of the skin was torn off the front of the leg and dorsum of the foot and was hanging in irregular flaps. The muscles of the anterior compartment were badly lacerated and all the tendons were avulsed from the muscle bellies. The ankle-joint and tarsal joints were opened. The wound contained much dirt. The skin edges and all damaged skin and muscle were cut away and dirt and manure was flushed out with saline. The wound was then mopped dry and powdered with urea, vaseline gauze bandaging applied and the limb was placed in a closed plaster. After three weeks pus soaked through the plaster but there was not much smell and much less than that in a previous similar case treated without urea. The plaster was removed and the treatment repeated. After three weeks the plaster was not much soaked but was removed and considerable healing had taken place and there were healthy granulations. Skin grafting was carried out and the child was left with a fairly useful limb though no movement was possible at the ankle-joint. Throughout the treatment the temperature did not exceed 100° F.

Case 2.—A man aged 40 slipped on some mud and fell. He sustained soiled compound fractures of the left radius and ulna. The wounds were excised, washed with saline, packed with urea and sutured. A closed plaster was applied with the elbow in flexion. The wounds healed by first intention and there was no pyrexia at any time following the operation.

Case 3.—A man aged 25 fell from a motor cycle and sustained loss of the skin of about half the distal part of the palm and extensive lacerations of the volar aspects of all the fingers and the back of the hand. The pulp and both phalanges of the thumb were missing, only the skin and nail remaining. All the metacarpals except the fifth and all the proximal phalanges of the fingers were fractured and the wound contained much dirt and grit. The patient claimed "good healing flesh" and requested the utmost conservatism in treatment. Skin edges and damaged tissue were excised and the wound was cleaned with saline, dressed with vaseline gauze and bandaged to a splint. Large doses of M & B 693 were administered during the first two days. The wound became badly infected and the fourth finger gangrenous and there was considerable smell. The patient refused to believe that the gangrenous finger was incapable of recovery and declined to have it amputated. The hand was liberally sprinkled with pure urea and bound up in jaconet and bandaged to a splint. Infection which was spreading up the arm at once became localized and the hand became less painful and, in spite of crushed bones and lacerated tendons and the presence of a gangrenous finger, the infection remained localized and benign. Pus collected between the fingers and was washed away. Healthy granulations soon covered the wound and most of the pus was seen to be coming from the fifth flexor tendon sheath. The hand eventually healed. During urea treatment the absence of swelling of the fingers was conspicuous.

Case 4.—A man aged 21 was operated upon for perinephric abscess through a Mayo incision. He discharged blood-stained thick pus for six days which poured out beyond the dressings. The wound was flushed out with a saturated solution of urea by means of a catheter and funnel after which barely sufficient discharge to soil the dressings came away. The coincident dramatic improvement in his clinical condition was remarkable.

Case 5.—A man aged 24 was bitten on the ankle by a cobra. Native medicines were applied and he was taken to a military hospital where he was given

antivenene. For three months the ankle remained swollen and painful and the patient suffered from giddiness. He then fell and twisted the ankle and it became so grossly swollen and painful that fracture was suspected. Two days later an abscess burst and pus was discharged through two openings on the lateral aspect. The two openings were joined by an incision but pus continued to be discharged for six weeks. The abscess was packed with urea under a closed dressing for six days. On removing the dressing all that remained was a small ulcer representing the incision. Two days later a swelling appeared on the medial side of the foot which subsided with fomentations. Evidently a small pocket had escaped the full action of the urea. Four days later the patient was discharged cured except for some stiffness.

Case 6.—A soldier aged 28 was shot through the left thumb by a rifle bullet which caused disintegration of the metacarpophalangeal joint. He was invalided back to India. On removing the closed plaster he was found to have a pin-point sinus on the volar aspect and a one inch irregular opening on the dorsum. Through the latter sequestra were removed and the wound was packed with pure urea and a closed plaster applied. No discharge appeared for three days. On the fourth day a serous discharge exuded from under the plaster and it became purulent on the twelfth day. On removing the plaster the dorsal wound had healed leaving a pin-point sinus.

Case 7.—A water carrier aged 18 was admitted to hospital with paronychia following breaking of the nail of the left great toe. This was treated with fomentations and eusol dressings. Twenty days later the nail was removed as there was no improvement. A foul stinking discharge persisted for five months in spite of dressing with concentrated magnesium sulphate, hypertonic sodium sulphate, saline packs and flavine in rotation. X-ray showed no bone involvement and the discharge showed ordinary pyogenic cocci and no fungoid organisms. The nail had commenced to grow and was one-eighth of an inch long. One treatment with urea deodorized the wound and two further treatments resulted in healing and the patient's discharge from hospital.

Case 8.—A man aged 26 fell from a chair and sustained a laceration of the buttock which discharged pus for a month. He was then admitted to hospital and a piece of wood three inches long was extracted from the wound. Pus continued to discharge. Three weeks later there was no improvement and the sinus was gently curetted under anæsthetic and packed with urea. On removing the dressings a week later it was noted that the discharge was serous and scanty. Two further weekly treatments resulted in healing with very little scarring.

Urea is a substance which is cheap, stable and an efficient bactericide. It is capable of preventing infection in a fresh contaminated wound and of controlling or eliminating bacterial growth in an infected wound. In addition, it appears to have some power of removing or promoting the solution of necrotic tissue but does not seem to exert any harmful influence on living tissues even when placed in contact with them in one hundred per cent concentration. It is freely soluble and diffusible and while it exerts little, if any, osmotic effect it no doubt soon becomes diluted, absorbed and excreted. The wound into which it has been put remains bathed in an innocuous medium, often completely sterile, which allows of rapid healing. Muldavin and Holtzmann state that it appears to have no direct power of stimulating epithelialization. From clinical observations of wounds, however, it seems very dubious if epithelialization can be "stimulated."

Epithelium will grow over any wound surface at its own rate when the conditions which prevent it from doing so are removed. The cases quoted as examples are, with the exception of the first, from current practice in a military hospital where urea treatment has not been used as a routine because it is not an authorized drug and supplies are limited. It has therefore only been used in exceptional cases and in cases where other methods of treatment had failed. Admittedly to accurately judge the true value of this treatment requires a large scale controlled series compared also with the sulphonamide pack method. The rising popularity of the latter method is at present based more on the opinions of individual surgeons than upon statistical records of controlled series of cases (Colebrook, 1940). Until more precise information becomes available it seems to be not inopportune to make a plea for the revival, with or without modification, of what Kirk advocated in 1915.

REFERENCES.

- COLEBROOK, L. (1940). *Brit. Med. Journ.*, November 16, 682.
HOLDER, H. G., and MCKAY (1937). *Journ. Amer. Med. Assn.*, **108**, 1167.
MULDAVIN, L. F., and HOLTZMANN, J. M. (1938). *Lancet*, **1**, 549.
ROBINSON, W. (1936). *Amer. Journ. Surg.*, **33**, 192.
STONHAM, F. V. (1940). *Ind. Med. Gaz.*, lxxv, **9**, 575.
SYMMERS, W. ST. CLAIR, and KIRK, T. S. (1915). *Lancet*, December 4, 1237.
Idem. (1915). *Med. Press and Circular*, December 4.
WILSON, W. J. (1907). *Journ. Path. Bact.*, **11**, 394.

A PORTABLE STEAM FIELD DISINFESTOR.

BY MAJOR ROBERT G. W. OLLERENSHAW, M.A., B.M., M.R.C.S.,
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THE present situation of the troops at home entails the accommodation of detachments of varying sizes in an astonishing variety of billets, requisitioned houses and converted mills.

While there are many units and formations which are large enough to justify the installation of a permanent disinfestor of one of the recognized commercial types, it has been found that there are many more, such as the detachments guarding vulnerable points, where the numbers do not justify the expense of a permanent installation. Moreover, it is just these small isolated detachments which are most liable to infestation by pediculi or scabies as they are frequently very badly placed in regard to bathing and laundry facilities.

It has not been found a practicable proposition to employ the Millbank Portable Disinfestor, with its trained staff, in cases where there are less than, say, a hundred men to deal with and the construction of a fixed field disinfestor, such as the Serbian Barrel, at each vulnerable point or group of requisitioned buildings has been found to lie beyond the capacity of the majority of units, many of which are extremely scattered.

It therefore occurred to me that a simple portable steam disinfestor which, while being within the capabilities of the average unit to construct, was yet compact enough to be moved around their various detachments and sufficiently foolproof to be worked by unskilled regimental personnel, would be a useful and desirable piece of equipment.

GENERAL DESCRIPTION.

From past experience of several improvised field disinfestors, a variety of points arose which it was desired to incorporate, with a view to increase of operating efficiency.

The standard ten-gallon oil drum was the obvious choice for the boiler; the five-gallon drum has been found to be inadequate when anything larger than an ordinary beer-barrel is used as the clothing container. Moreover, it was considered desirable to make the steam generating plant sufficiently large to feed a bigger container, since we had been informed that a substantial number of hundred-and-fifty-gallon wine-casks, which would each take up to sixty blankets at one time, were available for purchase. In any case, the larger boiler will always feed a smaller container.

The standard ten-gallon drum measures 21 inches by 14 inches overall and it is these dimensions which settle all the others for the steam generator.

The firebox, the top part of which forms both the cradle for the boiler and the smokebox, is constructed of any available stout sheet metal, bent and riveted as described in detail on page 251.

It was decided that the entire apparatus must be able to be constructed from stock fittings and materials ; no workshop intervention must be essential. This is not to say, however, that the co-operation of a Field Workshop would not be extremely valuable.

The chimney is a section of standard three-inch stovepipe, such as is employed with the slow-combustion stoves which are being fitted in hutted camps. The loose chimney of the old pattern "Soyer" cooker may be used in place of this pipe. The modern pattern unfortunately has a fixed chimney. Steam piping is the standard iron gas "barrel" and all elbows, unions and backnuts are standard and from stock. Ordinary angle-iron, such as may be obtained from many salvage piles in the form of old bed-sides, provides the supports for the baffle-plate and for the firebars and firebox lining.

This baffle-plate is situated between the firebox and the boiler. It is not included in the fixed Serbian Barrel as described in the Army Manual of Hygiene and Sanitation (1934) [1] but it has been found by experience to be necessary. The thin metal (lead-coated iron of approximately 20 S.W.G. in thickness) from which most oil-drums are made will not stand up to the direct heat of the flames without burning through in a short time, which varies from drum to drum but which in one case was as short as a fortnight. Should unskilled attendants allow the generator to boil dry the life of the drum may be even shorter. The baffle, while admittedly increasing the time needed to get steam up, takes all the "burning"—and can be scrapped when it gives way, being easily replaced by any stray piece of thin sheet iron—which cannot be said for the boiler, with its carefully brazed pipe-unions.

The same simplicity of replacement is the principle underlying the loose lining and the firebars. The bars rest in notches cut in their supporting angle-irons and can be replaced in a moment by any odd pieces of railing picked off the scrap-heap while the lining of the firebox is simply sheet metal with two right-angle bends.

This tendency of parts to burn out has in the past been the great bugbear of the improvised field disinfector. The present model overcomes this difficulty by making the vulnerable parts easily replaceable and by lining the sheet metal sides of the firebox itself with asbestos sheeting, such as is used to protect the woodwork of huts behind the stoves, and which is fairly easily obtainable from the Sappers, in addition to the loose metal lining described above.

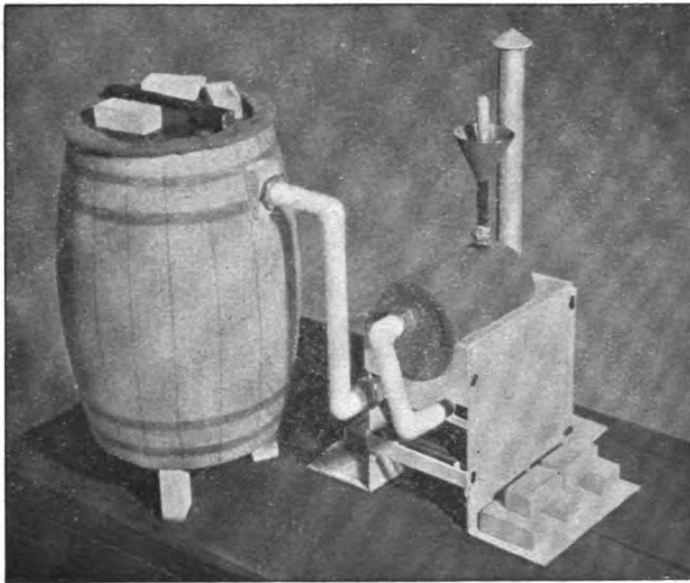
The generator is coal-fired, in view of the present difficulty in obtaining wickless oil stoves or petrol burners or their fuel, although these types of heater have many advantages, were they more easily obtainable.

The clothing-container, or Serbian Barrel proper, which is ideally made

from one of the large wine-casks referred to above, can at a pinch be made from any steam-tight container, on the lines of the Packing-case Disinfector or the Lelean Sack, although in cold weather this last loses too much heat to be really satisfactory.

The principle of sectional construction, which is to be described in detail, renders it possible to pack the entire plant inside the barrel which can then be moved from point to point by unit transport with considerable ease.

The lagging by a bank of earth, as described in the Manual for the fixed Serbian Barrel, is obviously out of the question in a portable model and, in any case, I have found that its value, especially in weather such as prevailed in the winter of 1939-40, is problematical. During that period the bank



Photograph of original scale model of Portable Disinfector.

froze solid, and tended to refrigerate the barrel rather than to conserve heat.

The portable barrel has therefore been *internally* lagged with a layer of blanket, nailed firmly around the top and bottom edges, and tightly stretched. This procedure leaves an air-space between the blanket and the curved wall of the barrel. The air-space, being a poor conductor, provides a measure of insulation which I have found to be more efficient than the bank of earth.

The blanket is turned six layers thick over the top edge of the barrel, and the lid is covered on its under surface by two layers. The contact between these two padded surfaces is excellent, and when the lid is weighted

by a few bricks the joint is to all practical intents steamtight. Half a dozen bricks are also needed to raise the perforated bottom of the barrel off the ground and thus allow free exit for the spent steam. The necessary bricks can usually be found on the site.

Where the ground conditions are suitable, it may be found possible either to sink the barrel into a pit, leaving several inches clearance all round, or to raise the steam generator off the ground on old masonry. If this can be done, the total run of steam piping may be reduced by the elimination of the vertical limb (*see fig. on page 250*).

The drawing in the Manual shows the steam feed-pipe led only just through the wall of the barrel, near the top. While this provides the essential downward feed, it has been found that there is a tendency, if the blankets are unskilfully packed, for an air-pocket to form near the top, at a point opposite the entry of the pipe. This is avoided by delivering the steam through a rather longer feed-pipe, so that it escapes at the mid-point of the diameter and as near the top as possible through an upturned elbow. The steam, after impinging on the under surface of the lid, is evenly distributed all round. This apparently small point can prevent the escape of a few lice in the top blanket and the subsequent reinfestation of the whole batch.

GENERAL CONSIDERATIONS AFFECTING THE FITTING OF A SUPERHEATER.

While it is well known that superheated steam, being a gas, has poor penetrating properties and is not therefore so efficient a disinfesting agent as current steam, a simple U-tube superheater running through the firebox, between the boiler and the baffle, was fitted for the following reasons :—

In the ordinary type of disinfector, without superheater, the steam leaves the boiler at 100° C., as current steam, possessing a latent heat of 537 calories per gramme and having expanded some 1,700 times in changing from water at boiling point to steam. During its passage through the piping it cools down considerably and it again cools, very rapidly, with contraction and cloud formation, on its escape into the barrel. There is thus a considerable loss of potential "disinfesting value" at the very outset, as the so-called "steam" reaching the blankets is, to a great extent, water in the form of cloud. In condensing back to water, steam contracts to $\frac{1}{1700}$ of its volume and, in so doing, gives up its latent heat. But since the steam has already partially condensed, the full value of this effect is lost. The contraction, which lowers the pressure within the barrel, not only tends to draw over more steam from the boiler but also, by reason of its tendency to produce a vacuum, increases the power of the steam to penetrate the blankets. The total loss of efficiency from both causes is obvious.

The effect of the superheater is that steam leaves the U-tube at a temperature considerably above 100° C., with the result that it reaches the

barrel at approximately boiling point, the additional heat having served to compensate for the inevitable losses due to cooling in the feed system.

Thus *true current steam* is fed to the infested blankets, having none of the disadvantages of a gas but having the advantage over the simple type of feed that it is truly at boiling point and, in condensing and contracting, it can yield up the whole of its 537 calories per gramme of latent heat to the blankets, with a consequent gain in efficiency and a reduction in the time required for safe disinfection.

TIME REQUIRED FOR ADEQUATE DISINFESTATION.

No definite time is laid down in the Manual of Hygiene and Sanitation for disinfection by the Serbian Barrel. The most recent investigations of temperatures lethal to the louse are those of Buxton (1940 *a, b*), [2, 3]. The *minimum* time required for the destruction of lice is of academic value since, in the field, an exposure well above this will invariably be given. As Buxton says, practical disinfestors do not regard ova (which are much more resistant than mature lice) as dead until they are collapsed and shrunk, a state which indicates that they have been subjected to a temperature well above the lethal threshold. Mature ova do not shrink unless they are exposed to a temperature of 65° C. for ten minutes. It is probably advisable to allow this period to elapse from the time when cloud is seen to be coming freely from the perforated bottom of the barrel.

This is considerably less than the exposure times and temperatures which were formerly thought to be necessary (Jameson and Parkinson, 1936) [4], and, when the superheater is in use, the safety factor is considerable, even with such short exposures.

It should, however, be remembered that a temperature which will kill lice and their ova will not necessarily sterilize the bacteria or viruses which they may be carrying. The custom of speaking of a Serbian Barrel as a "disinfector," instead of as a "disinfestor" is a dangerous one.

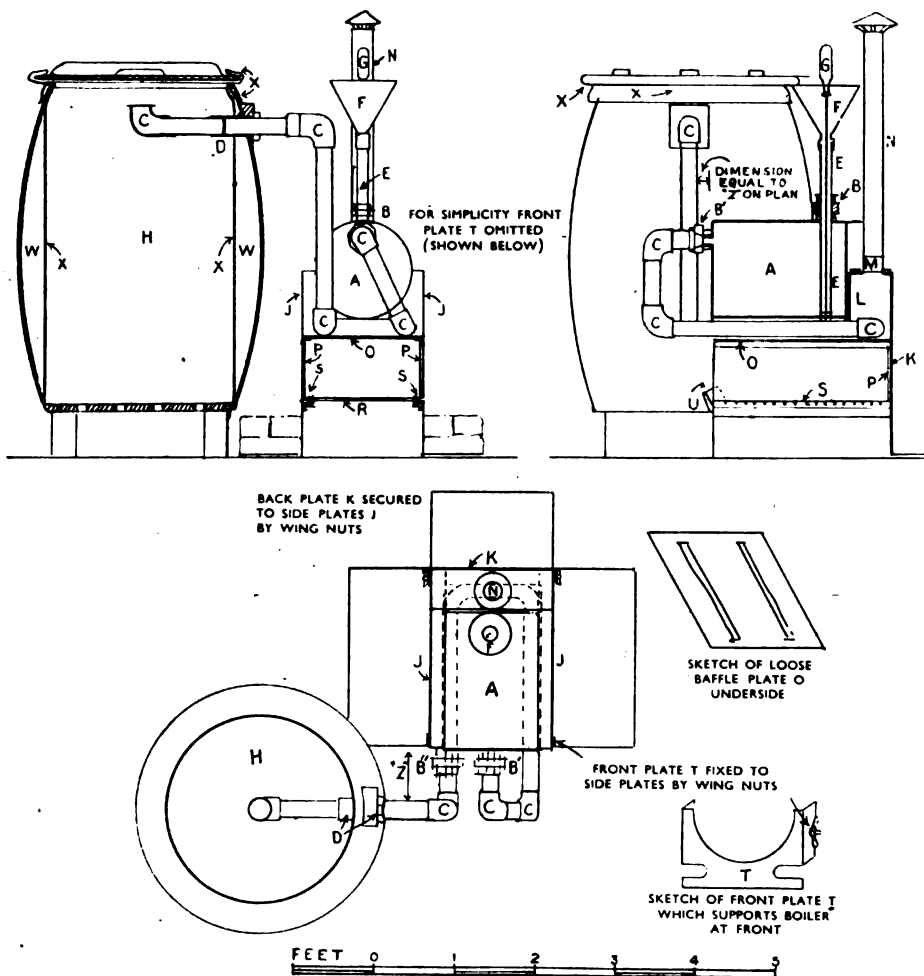
DETAILED DESCRIPTION OF CONSTRUCTION.

(See Plan. Letters refer to the Key thereon.)

The Boiler (A), a ten-gallon drum, lies horizontally. It is fitted with a *Filler-pipe* (E) made from $\frac{3}{4}$ -inch iron barrel. This is brazed in, and runs to within 1 inch of the bottom of the boiler, extending also 18 inches above the point of entry. It is broken just above the boiler by a screw-union (B) in order to facilitate packing for transport. *The Funnel* (F) may be an ordinary petrol-funnel, soldered to the pipe. In addition to its action as a filler and safety-valve, this pipe will emit a cloud of "steam" when the water level becomes dangerously low, and will warn the attendant to refill, if he is to avoid burning out the boiler.

The steam-outlet runs from the uppermost point of the opposite end of the boiler, to which is brazed the female half of a screw-union (B'). This

is of $1\frac{1}{2}$ to 2 inches bore, thus rendering it impossible for the filler and outlet pipes to be wrongly connected. The corresponding male half-union is fixed to the superheater pipe. This runs downwards, as shown, and thence horizontally below the boiler, in the form of a U, lying within the smokebox. At the point where the pipe leaves the smokebox a second screw-union is fitted (B"), again for ease in packing. These joints will stand up to 50



pounds per square inch pressure and therefore no risk of steam leakage is involved.

From this union the pipe runs up to its point of entry into the barrel. The plan shows how the short section within the barrel (D) unscrews from the main pipe by means of a straight socket. The main pipe can then be withdrawn from the barrel for packing. The short section ends in the

upturned elbow previously described. The point of entry into the barrel should be kept as high as possible, in order to secure freedom from air-pocketing. A wooden block is fixed to the barrel wall, in order to keep the inlet hole "square" to the pipe. An ordinary backnut beds up against this and ensures a reasonably steam-tight joint, especially as the wood swells a little when damp.

The Firebox consists of two side-plates (J), a back-plate (K) and a small front-plate (T). All these are bent-up from sheet metal, which should be of about 16 S.W.G. The back and sides have each a large flange which rests on the ground, a vertical part—the firebox wall proper—and a smaller horizontal flange at the top, extending inward to touch the end and sides of the boiler respectively. This top flange on the *back-plate* overlaps the flanges on the *side-plates* and carries, riveted to it, the short *stub* of pipe for the chimney (M). To the front of this flange there is secured by a wing-nut the *bracket* (L), supporting the rear end of the boiler. This is simply a 2-inch strip of sheet metal, bent twice at a right-angle, as shown in the plan (side elevation). The back-plate is also flanged up the edges, in order that it may be secured to the side-plates by wing-nuts. Reference to the plan will make the above points much clearer than can be done in text.

The front-plate (T) is sketched separately. The deep notches at the sides are cut to clear the superheater pipes and will therefore vary with the size of pipe available. This plate also forms the support for the front end of the boiler. It is secured to the side-plates by wing-nuts.

Asbestos sheeting is fastened by rivets to all four of the above plates, on their inner surfaces.

Six sections of light angle-iron are now required, the length of the side-plates. Two of these are riveted on as supports for the baffle-plate (O). Two others are deeply notched at $1\frac{1}{2}$ -inch intervals to take $\frac{1}{2}$ -inch firebars. These are now riveted "back-to-back" with the remaining two sections, and these in turn are riveted to the side-plates at (S). The two elevations in the plan make the arrangement clear. All angles should be fixed *after* the fitting of the asbestos lining.

The addition, by wing-nuts, of a small plate (U) to prevent the coal falling out completes the firebox proper.

The chimney (N) is a push-fit on the stub (M).

Replaceable Sections.

These are three; the baffle-plate, the firebox liner, and the firebars.

The baffle-plate is sketched at (O). It lies on the upper angle-irons, and is slotted below the superheater pipe. The slots may be quite rough, and simply knocked through with a cold chisel. It will be noted that the only way from the firebox to the chimney is through these slots, and that therefore the full heat plays on the superheater, while the centre of the plate protects the boiler.

The *firebox liner* (P) is made from a single piece of sheet metal, bent to form three sides of a rectangle rather smaller than the firebox. It rests on the lower angle-irons (S) which also support the seventeen *firebars* in the notches described above. Almost any scrap rod or bar will serve for these bars.

The *barrel* (H) should be the largest that can be found. It is not the steaming that takes time but the constant packing and unpacking of a small barrel with clothing.

The bottom is freely perforated with a large auger and the barrel itself supported clear of the ground on bricks.

A plain flat lid, preferably fitted with a handle, is well lagged with blanket nailed round the edge. In use, it should be weighted with bricks to secure good contact.

The lining of the barrel with blanket is clearly shown at (X), leaving the air-space (W). The fitting of the feed-pipe to the barrel has already been described.

Finally, a *dipstick* (G) will be found to be most valuable. It should be notched to show the correct water-level, and the attendant warned not to exceed this; the risk of water flowing over into the superheater is thus avoided. Should this happen in spite of precaution, uncouple the screw-unions, when the pipes can be easily cleared.

GENERAL NOTES.

Extreme of constructional detail has been avoided, as much will depend on the local availability of material.

By the use of wing-nuts and screw-unions, it has been found possible to make the entire plant so dismountable that it can be packed inside the barrel. A pair of handles fitted to the sides of the barrel make transport a matter of the utmost simplicity.

It is advisable, where this material can be obtained, to lag the exposed steam pipes with asbestos yarn; in the absence of this, strips of blanket or hessian will serve but are not such good insulators.

SUMMARY.

(1) A steam field disinfector, based on the Serbian Barrel, is described. It can be constructed, by local resources, from material which can be mainly "scrounged." It is entirely dismountable, so that it can be packed within the barrel intended for the clothing, and moved from site to site.

(2) This is of especial importance in the present situation where there are large numbers of troops employed in small isolated detachments, often with poor bathing and laundry facilities, and with increased liability to infestation.

(3) A superheater is included and the rationale of this is discussed.

(4) A feature is the simplicity of replacement of parts liable to burn out.

(5) The use of standard wing-nuts, screw-unions and different sizes of piping make the apparatus as nearly foolproof as possible. It can most certainly be operated by the personnel who transport it without constant expert supervision.

ACKNOWLEDGMENTS.

It is my pleasant duty to acknowledge the great assistance and helpful criticism which I have received from Colonel N. Low, *D.S.O.*, *O.B.E.*, *A.D.M.S.* ———, whose opinions, as a former Professor of Hygiene at the Royal Army Medical College, were especially valuable.

My thanks are also due to Lieutenant E. F. Massey, Royal Engineers, and to the staff of the D.C.R.E. ———, for advice on certain technicalities and for the preparation of the drawings.

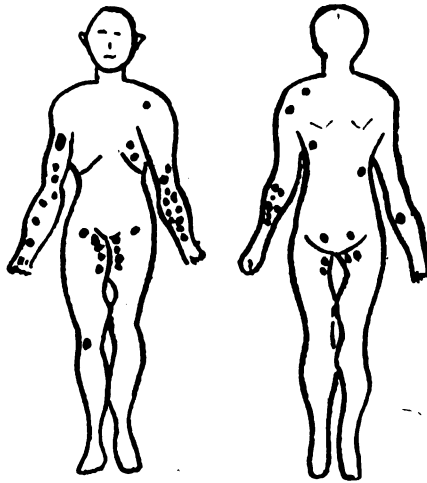
REFERENCES.

- [1] Army Manual of Hygiene and Sanitation (1934).
- [2] BUXTON, P. A. (1940 *a*). "Temperatures Lethal to the Louse." *Brit. Med. Journ.* March 20, p. 341.
- [3] *Idem* (1940 *b*). "The Control of Lice," *Ibid.*, November 2, p. 603.
- [4] JAMESON, W. W., and PARKINSON, G. S. (1936). "A Synopsis of Hygiene," 5th edition (Churchill).

SKIN ERUPTIONS FOLLOWING VACCINATION : REPORT ON A CASE.

BY MAJOR H. D. CHALKE,
Royal Army Medical Corps.

SKIN eruptions are not a common sequel of vaccination and their incidence would appear to be less than formerly. They tend to occur more often after primary vaccination than in re-vaccinated subjects. The abandonment of the method of cross-hatching in favour of the single linear insertion has probably been one of the causes of the decreased incidence of these rashes. Greater regard to asepsis in the act of vaccination as well as in the protection of the vaccinated area has also been an important factor in this.



Distribution of the lesions.

Increased care in the preparation of the lymph, which formerly was often contaminated, is also a point of importance in this connexion.

Different types of rashes may occur. These vary from the local erythema, of greater or less extent, which is a constant accompaniment of successful vaccination, to lesions which embrace either the affected arm or other parts of the body. Papulo-vesicular, erythematous and "serum" type rashes were described in the Report of the Committee on Vaccination [1]. Although most often confined to the vaccinated arm they were occasionally found in other situations. Ricketts stated that the generalized erythematous eruptions were associated with secondary products of inflammation. Papular and papulo-vesicular lesions (vaccinal lichen) he believed to be toxæmic

manifestations [2]. Many of the specific eruptions of generalized vaccinia recorded in the past were possibly variolous ; they followed the use of lymph containing the virus of smallpox. The appearance of a generalized vaccinia in a child who had sucked the vaccine pustule of another child is recorded. Auto-inoculation may occur when there are cuts or abrasions elsewhere on the body or when skin diseases co-exist. Such sequelæ are, however, surprisingly rare. The infrequency of generalized vaccinia is shown by the following figures, quoted by Rolleston [3] :

France	6 to 8 cases	among 600,000 vaccinated.
Denmark	4 cases	among 40,000 vaccinated.
Germany	5 cases	among 100,000 vaccinated.

Difficulties in diagnosis are very liable to arise during a smallpox epidemic when vaccination, performed late in the incubation period, may modify but not prevent an attack of smallpox. A certain similarity in distribution between variolous and non-variolous lesions such as vaccinal lichen may increase these difficulties. Lichen urticatus, a common skin disease of early life, is almost indistinguishable from vaccinal lichen [4]. The author, in 1931, described 14 cases in which a skin eruption followed vaccination [5]. The cases occurred in London during an epidemic of modified smallpox. Some were notified as smallpox, others were discovered during the routine examination of smallpox contacts. All the patients were children most of whom came from homes in which cleanliness was not a predominant feature. Vaccination was primary in every case, one linear insertion being made. The eruptions appeared between the ninth and fifteenth days after vaccination. In some cases the rash consisted of small papules on which crusts appeared in about forty-eight hours. In others the lesions were maculo-papular, with or without urticarial blebs. In certain instances the rash became almost morbiliform after the lapse of one or two days. In the cases which resembled lichen urticatus pruritus was absent. In general the distribution was somewhat akin to that of smallpox but the face remained unaffected and prominences and points of pressure or irritation were not unduly favoured.

REPORT OF A CASE.

A healthy soldier noticed a small pimple on the wrist eleven days after primary vaccination on the opposite arm. He stated that he had not previously suffered from any form of skin disease. There had been a moderate local reaction with a considerable zone of erythema and some œdema of the arm. Further papules made their appearance during the next seven days. The patient was first seen on the tenth day of the eruption or nearly three weeks after vaccination. There was a fairly profuse eruption of superficial, irregular vesicles from $\frac{1}{4}$ to 1 inch in diameter, many with small crusts in their centres. Little or no surrounding erythema was noticed. Pruritus had been absent from the commencement. The rash was most plentiful on the forearms, thighs and scrotal region. The distribution is



FIG. 1



FIG. 2.

indicated in the diagram and in figs. 1 and 2. During the next week the vesicles dried up completely and there was generalized crusting. By the twentieth day after its first appearance nothing remained of the rash but large, irregular, pigmented areas (fig. 3).



FIG. 3.

SUMMARY.

A case is described in which a papular urticaria appeared on the eleventh day after primary vaccination. That the condition was a toxæmic manifestation, associated with vaccination, may be assumed from the time of its appearance. The occurrence of these rashes at a time when the vaccinal reaction is at its height, i.e. between the ninth and fourteenth days, was a constant feature in the cases previously described. The character and distribution of the lesions also closely resembled those of the former cases. The marked pigmentation which followed was, however, an unusual feature.

Despite the large number of primary vaccinations being performed on

soldiers at the present time, sequelæ of this nature would still appear to be rare. Local inquiry has not brought to light any record of other cases of this nature among vaccinated soldiers. Further information on this point would be of interest.

I am indebted to Dr. Hamilton Wilkie of Leicester for his kindness in taking the photographs and to Colonel F. R. Coppinger, *O.B.E.*, for permission to forward these notes for publication.

The originals are in colour and show the condition very well but, in view of present difficulties, black and white prints are substituted.

REFERENCES.

- [1] Report of the Committee on Vaccination. Ministry of Health, 1938.
- [2] RICKETTS, T. F., and BYLES, J. B. (1908). "Diagnosis of Smallpox." London.
- [3] ROLLESTON, J. D. (1925). "Acute Infectious Diseases." London.
- [4] CHALKE, H. D. (1932). "Lichen Urticatus: A Differential Diagnosis of Smallpox." *Brit. Med. Journ.*, January 24.
- [5] *Idem* (1931). "Observations on Skin Eruptions following Vaccination." *Lancet*, March 14.

REPORT ON A GROUP OF CASES OF BENIGN TERTIAN MALARIA
WHICH IN THE EARLY STAGES SIMULATED GERMAN
MEASLES.

BY MAJOR C. M. VAILLANT,
Royal Army Medical Corps.

SOME three months ago an officer patient was admitted to the hospital from a fighting unit with the diagnosis of German measles. At the time this was considered correct and we discussed how long he should remain isolated since in the last war it had been quite usual to do so for no longer than forty-eight hours.

The matter however resolved itself in an unexpected manner. Two nights later a convoy of twenty other ranks arrived from the unit, all with the same diagnosis. Most of them presented a rash indistinguishable, in the daylight, from that of German measles; conjunctival injection was present with pains behind the eyes and headache chiefly across the top of the forehead. The temperatures ranged around 101° to 103° F. In every case one sign was conspicuously absent; clinically there was no occipital adenitis. The diagnosis had been made before the men left their unit on grounds of the rash and the journey here had occupied some forty-eight hours. The rash, therefore, had persisted for about seventy-two hours and was more marked in some than in others. Treatment was symptomatic.

On the second morning it was decided that the fever was not following its true course since the temperature had not subsided, headache was persistent and in some cases the rash showed no sign of abatement. One patient, perhaps the most seriously ill of all, complained of left-sided upper abdominal pain. His spleen was tender and easily palpable and he admitted to similar symptoms in previous attacks of malaria. In six more cases the spleen was felt in greater or less degree. Blood films from all the patients were examined and the parasite of benign tertian malaria was found in each case. Standard treatment with quinine by mouth led to complete and uneventful recovery with disappearance of the rash in every patient. Later, more cases arrived making a total of about fifty.

At the time not a great deal of attention was paid to the rash, which was thought to originate from excessive perspiration, but it was considered advisable that the unit medical officer be informed. Gradually this finding became known locally and one had the opportunity of hearing the views of many doctors with large experience of malaria and of all its manifestations.

With one notable exception, they were most emphatic that they had never seen a rash in malaria provided no treatment had been given. Of the first twenty at least it may be stated that no treatment had been given

since they had had the rash when they went sick ; unless, of course, they had been getting it unofficially before reporting at sick parade.

It is not possible under present circumstances to inspect the literature on the history of malaria but all who have discussed the problem have had considerable experience and therefore their opinions carry weight. On the other hand the facts are beyond dispute. The unit inadvertently camped late one night near a swamp and soon afterwards several of its strength reported sick with malaise, fever, conjunctivitis and headache, accompanied by a rubelliform rash but without occipital adenitis. I have since had an opportunity of confirming this last point from their medical officer. Blood samples of the first twenty sick contained benign tertian malaria parasites and recovery was complete when treated with quinine. Finally, it has been ascertained that the date of exposure in the swamp was consistent with the incubation time of benign tertian malaria.

A possible explanation is that the men all had malaria parasites in their blood when an epidemic of German measles supervened ; but I have never seen a case of rubella without occipital adenitis and under these circumstances I consider the alternative untenable. Furthermore it is beyond the bounds of reasonable probability that every case of malaria should have German measles and that every case of clinical German measles should also have malaria. Finally, it seems unnecessary to postulate an unknown secondary infection and one concludes that these cases provide the very unusual combination of a rubelliform rash with benign tertian malaria, a complication not generally recognized.

I wish to thank Lieut.-Colonel A. Harrison-Hall, R.A.M.C., for permission to present this report and also for his welcome and constructive criticisms.

NOTE BY CONSULTANT IN TROPICAL MEDICINE, MIDDLE EAST FORCE.

I discussed these cases when I was down in the Sudan with Major Vaillant.

From what he told me and from the fact that nineteen of the twenty cases were shown to have malarial parasites in their blood, the obvious explanation is that all the cases had malaria and *prickly heat*.

The rash of prickly heat very closely resembles that of measles and I have often found typical cases of the former condition isolated under the mistaken impression that they were measles.

NOTE BY ASSISTANT PROFESSOR OF TROPICAL MEDICINE,
ROYAL ARMY MEDICAL COLLEGE.

An erythema, which may closely simulate that of scarlatina, is described as a not uncommon eruption with malaria. It is, however, improbable that such an erythema would be present in every one of twenty cases.

The opinion of Colonel Smith that these patients had malaria and prickly heat seems the most likely to be correct and it is possible that only in those who suffered from the fever and excessive sweating of malarial paroxysms did the lesions of prickly heat, probably common to all members of the unit, adopt a morbilliform character.

DRUM PORTABLE DISINFECTOR.

BY MAJOR J. T. WYBOURN,

Royal Army Medical Corps.

CURRENT pressure steam disinfection with downward displacement has been shown, by experience, to be the most reliable method.

Field Hygiene Sections are provided with disinfectors able to deal with 1,000 blankets a day, transported on a 3-ton lorry, which disinfectors are admirable in dealing with the routine disinfection of blankets, bedding and kits of large units.

It is neither practicable nor economical to despatch such apparatus to large units for the occasional disinfection necessary following isolated cases of scabies or other infection. Neither are they suitable to meet the requirements of units comprised of several scattered detachments, viz.: L.A.A. Regiments, S/L units and V.P.s, to mention a few.

What is required for these purposes is a disinfector which is reliable, cheap, easily and speedily assembled, conveniently transported on a light van or 8-cwt. P.U. truck and finally requiring no highly technical knowledge to carry out the work.

This disinfector, it is claimed, meets all these requirements.

The materials necessary for its construction are detailed hereunder :

1 50-gallon drum ; 1 5-gallon drum ; 38 feet 2 inch by 2 inch deal or other seasoned wood ; $2\frac{1}{2}$ feet of 1 inch iron piping ; 4 1 inch by $1\frac{1}{4}$ inch bolts ; 16 $\frac{3}{8}$ inch by $\frac{1}{8}$ inch rivets ; 18 2 inch by 12 inch screws ; 12 3 inch by 12 inch screws ; 8 $3\frac{1}{2}$ inch by $\frac{1}{2}$ inch nuts ; 4 $5\frac{1}{2}$ inch by $\frac{1}{2}$ inch nuts.

Briefly the details of the constructional technique are as follows :

(1) *50-gallon Drum*.—(a) One end of the drum is removed, 1 inch rim of this end is taken away and with a fitted handle is converted into a removable lid with 4 bolts and brackets (fig. 1).

(b) One 6 inch length piping is supported by a cone and fixed to each side of the drum, thus keeping it in position on the brackets.

A further 6 inch length piping is fitted to the closed end of the drum, into the collar already present in drum which is the steam entry of the disinfector.

(2) *5-gallon Drum*.—This is the proposed boiler. First it is assured that it is watertight. Two holes are then bored in one side and fitted with : (a) 6 inch pipe—which acts as steam exit. (b) 1 foot piping—which becomes filler and safety valve.

(3) *Wooden Stands*.—Two stands are constructed, each consisting of two triangles held together by crossbars. The crossbars are half jointed to the triangular ends with 3 inches protruding at each end, as shown in diagram, which gives details of the size.



FIG. 1



FIG. 2.

Excluding labour the total cost of all materials used has been found to be 25s. When packed ready for transport the total weight is 182 pounds.

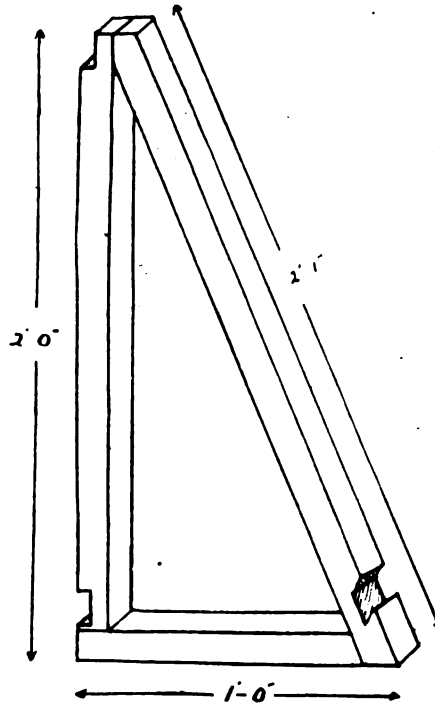


FIG. 3.—Showing shape of stand and position of crossbars. Shaded parts show joints. Joints are screwed together.

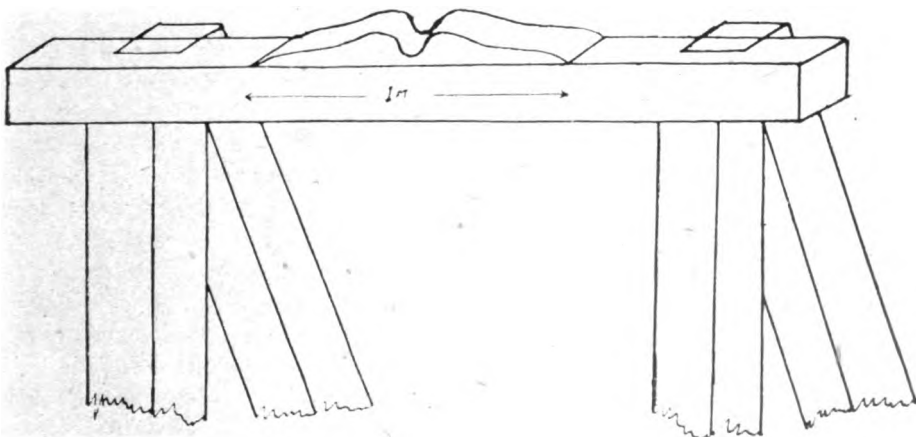


FIG. 4.—Showing bed for spindle, attached for drum to rest into. Lined with tin and screwed to crossbar.

The average time from removal from transport until complete assembly is seven minutes.

During the experimental stage with this model, the time taken for steam to percolate from the entry at the upper end of the drum to the exit at the lower end was estimated to be about twenty-five minutes, due to great loss of heat from the surface of the drum.

By placing a blanket around the disinfector the loss of heat is reduced and it is found in this way that steam is emitted from the bottom of the drum within six minutes of entry. A coal fire or alternatively a Hydra burner is used.

The estimated capacity of the drum is eighteen blankets or six complete kits. It has been tested several times with Temoine tubes and has given completely satisfactory results after three to four minutes' issue of steam, i.e. within ten minutes of entry of steam so disinfection can be conducted three to four times an hour.

Several models of this type have already been distributed to units where they have all proved efficient—being constructed by two carpenters and one tinsmith in one and a half days.

This model has been devised by a Field Hygiene Section and particular indebtedness is paid to the workshop staff who have been responsible for the constructional details under the supervision of the foreman, Corporal B. Stevens, R.A.M.C.

Figs. 1 and 2 show the disinfector packed ready for transport and assembled.

Figs. 3 and 4 show the details of construction of the wooden stands.



Editorial.

TUBERCULOSIS CARRIERS.

WHAT is a "carrier" of disease? When the word was first introduced to describe the state in typhoid ex-patients who continued to excrete bacilli though quite free from manifest disease we, in the Army, were left in no doubt as to the significance of the expression. We recall how, in 1908, we were called upon to investigate six of these unhappy men who had started outbreaks of typhoid while themselves in good health. All had been victims of the disease beforehand and had continued, unknown to themselves or their medical attendants, to pass germs in the urine or the fæces for periods of from six months to two years until, the circumstances being favourable, enteric fever had broken out in their immediate environment and had led to their examination and to the discovery that they were "carriers." Theirs was a hard lot. One was a serjeant well on the way to promotion. Others were or had been cooks. There was a corporal of the Artillery, as fine a soldier as one could wish to see. Treatment was unavailing and all of them were ultimately transferred to civil life and their Medical Officers of Health notified. And the tragic part of it was that there they were treated as lepers and turned from any decent employment that they had been so fortunate as to obtain! What else could be expected? A M.O.H. could not treat them otherwise when he was informed that they had already given rise to one outbreak of typhoid and might at any time give rise to another! And employers, once notified of the truth, were naturally unsympathetic to men who might lead to disease amongst their staff! The mention of the word "carrier" was enough. But what, in fact, is a "carrier"? The word cannot be confined to typhoid fever. The "diphtheria carrier" is sufficiently common to be accepted without demur, though he differs from the "typhoid carrier" in being far more curable than the latter. It is true that he has usually had an attack of the disease beforehand but this is by no means always the case.

We have lately seen letters in the medical press from tuberculosis specialists denying the applicability of the word to tuberculosis and of others asserting it! Which attitude are we to adopt?

Let us state at once that we regard the matter as settled beyond question. Tuberculosis "carriers" not merely exist but they are far too numerous for our safety or our comfort. If the term "disease carrier" means a person in relatively good health but who is excreting the germ, then we must include the "tuberculosis carrier" with the others. On the one hand, we may quote three cases brought to light by Webster in a recent paper in the *British Medical Journal*. These three men were perfectly healthy as

far as anyone could see. They had been examined both by thoroughly good clinicians for physical signs and by the X-ray methods in use in recruiting for the Australian Army. Miniature radiology has led to the detection of a large number of individuals but these cases were quite exceptional in that they were negative even to this most searching of tests! And yet they were found, on their sputum or gastric secretion being thoroughly examined, to be passing out tubercle bacilli. We ourselves recall a medical student in perfect health, with a lesion only visible in the X-ray film and so small as to be actually missed by a board of experts, who was yet an excreter of tubercle bacilli, a "carrier," not dangerous, perhaps, to normal adults as the number of bacilli was small, but of great danger to children and other susceptible persons. A series of somewhat similar cases has recently been recorded in the *British Medical Journal* in a paper entitled "Origin, Diagnosis and Management of Early Bronchogenic Tuberculosis," by Gregory Kayne. These cases may be regarded as exceptional in that they had not previously suffered from the disease. But what does it matter whether the individual has had previous signs or not as long as he is in good health and yet expectorating the bacilli? And what of the "completely restored" person who leaves the sanatorium with a fibrotic lung and perhaps with a single negative or, more likely, a positive sputum? Is his excellent general health to justify, for instance, his admission to the Army? Such men will try hard to get into the Service and may conceal the fact that they have already had a sanatorium interlude. They may, of course, sometimes do quite well but the great majority is bound to break down again later under the stress of active service or, perhaps, without this stress as they might have done in civil life.

Are we justified in accepting them without a thorough examination? The soldier may be one of a very crowded community in billets and in shelters or dug-outs! And in those very conditions the ex-sanatorium patient is likely to break down or at least to start excreting bacilli. This may not be a great disadvantage to him. He is likely to be found out sooner or later by the medical officer and to be returned to civilian life, with the prospect of a pension. But what about the healthy men around him? Are they or are they not being exposed to an unwarrantable risk? This will depend on the closeness of the contact, the restriction or otherwise of the billet or space, the length of time and a thousand and one things quite outside any medical control. We say definitely that the risk to these men is considerable and that an exposure of this kind is likely to increase the bill that the nation will have to face in pensions after the war. Nor do we forget that some young soldier may be, even now, inhaling the germ that will strike down his life or his health when he is just about to re-enter the society for which he had longed during his time of exile in his country's service. The tuberculosis "carrier" is not merely a reality but a much commoner reality than is generally supposed.

And how can he be detected? It is useless to expend clinical skill on a

search which can often defy clinical findings. There is nothing more certain than that the really early case is frequently quite fit and free from physical signs. To detect him one must have recourse to the skilfully taken X-ray picture and to the "reading" that, to be effective, must be made by a very experienced man. And to this "reading" must be added when necessary thorough investigation of the sputum or other material provided. These desiderata are not likely to be found in the rush and hurry of medical boarding. The only hopeful way seems to be by the application of "Miniature Radiology"—to all recruits or as many as possible!

Clinical and other Notes.

CONSTANT HOT WATER IN THE FIELD.

BY CAPTAIN D. B. WALLIS,
Royal Army Medical Corps.

A CONSTANT supply of running hot water in the field must always be a source of great convenience, especially to the Medical Services.

The author has attempted to devise a suitable apparatus made from readily available material to achieve this object.

The apparatus consists essentially of heating element, water reservoir, connecting tubes between reservoir and heating element and a draw-off pipe fitted with a three-way tap.

Heating Element.—This consists of the top and bottom of a non-returnable four-gallon petrol tin which are soldered together. One of the components is cut from the tin, leaving a $\frac{1}{4}$ inch edge all round, beaten diagonally from both corners.

The other component is cut without a free edge of tin, is drilled at each corner with a $\frac{1}{4}$ inch hole and a $\frac{1}{4}$ inch hole drilled centrally, and is then forced inside the lip of the first component, the outside part of each being on the outside.

The two are soldered together around the edge.

Reservoir.—This consists of a four-gallon petrol tin cut in two, the part chosen as reservoir being drilled in each of the four corners with a $\frac{1}{4}$ inch drill and drilled in one side to form a hole approximately the size of the cork which is going to form part of the tap, the hole being approximately $\frac{1}{8}$ inch above the base of the reservoir.

A handle is fitted.

Connecting Tubes.—These connect the heating element with the reservoir. A suitable suggested length is about 2 to 3 inches. The tubes are made in the following manner :

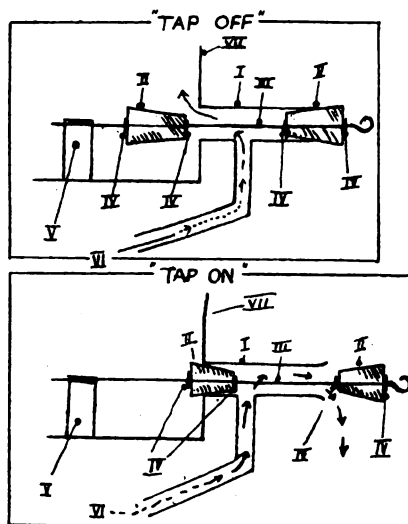
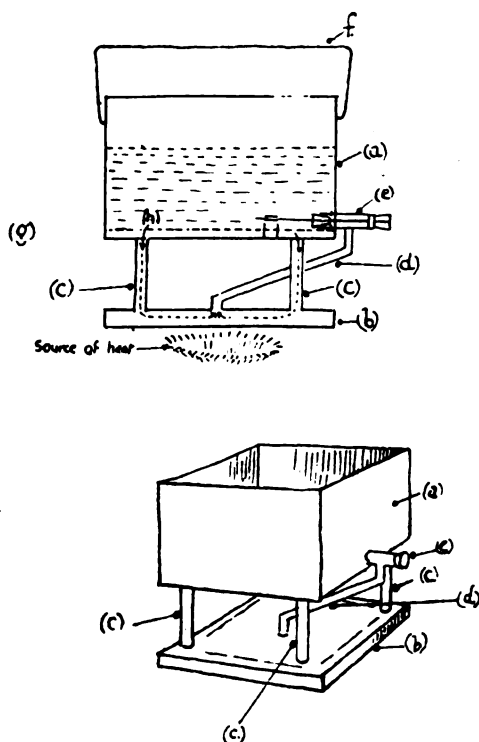
A 6-inch nail which has a diameter of $\frac{1}{4}$ inch is placed in a vice and tin is beaten around the nail with an overlap and soldered. The pipe thus made is cut into two with a hack-saw and the process repeated for further pipes. These pipes are now soldered between the holes made in the heating element and the holes made in the base of the reservoir.

Draw-off Pipe.—This pipe is made from tin rolled round a 6-inch nail and soldered overlapping. A further short length of piping is made, one end of each and either end of the draw-off tube being suitably angulated so that the draw-off pipe starting from the centre of the heating element comes to rest close to the hole made in the side of the reservoir.

The end of the draw-off pipe will be soldered into the tap.

The Tap.—To make the tap the following articles are required : 2 corks of any similar size ; 4 inches of stout wire and some tin.

The tap cylinder is formed by rolling round some suitable hard object such as a large-sized drill and soldering with overlap. The centre of the cylinder is drilled with a $\frac{1}{4}$ inch hole. One end of the cylinder is soldered to the hole in the side of the reservoir and the $\frac{1}{4}$ inch hole is soldered to the draw-off pipe. The stout wire is threaded through the centre of both corks, narrow ends towards each other, the wire being threaded through one cork,



KEY TO DIAGRAMS OF HEATER.

- (a) Reservoir
- (b) Heating Element approx $\frac{1}{4}$ " depth
- (c) Connecting Tubes
- (d) Drawing off Tube
- (e) Three-way Tap
- (f) Handle
- (g) Water Safety Level
- (h) Water Circulation

KEY TO TAP DIAGRAMS.

- I Tin Cylinder
- II Corks
- III Wire joining Corks
- IV Tin Discs soldered to wire to fix Corks
- V Tin Guide for Wire
- VI Water Circulation
- VII Section of Petrol Tin

through the cylinder and through the other cork. Each cork is kept in position by 2 circles of tin which compress the cork and are soldered to the wire so that when one cork is tight in the cylinder the other cork is pushed out of the cylinder. That part of the wire which is outside of the reservoir is formed into a circle to act as a handle and that part of the wire which is inside the reservoir is straight and kept in position by a guide, the guide of tin being soldered to the base of the reservoir.

How it Works.—The apparatus is first filled with water. On applying heat to the heating element it is found that the water circulates up the draw-off pipe to the three-way tap. When the tap is "off" it returns to the reservoir

or when the tap is "on" it is drawn off as required. The temperature of the circulating water within a minute rises to a temperature painful to touch and can be constantly drawn off at the rate of 1 pint per minute. In the "off" position the water circulates, the reservoir becoming progressively hotter if the heat is maintained. As an economy in fuel, however, when not in use the source of heat can be reduced, being turned up when hot water is required.

The total cost of the apparatus is that of the solder, wire and 2 corks.

Practical Use and Findings.—A model similar to the one described has been in use for three to four months for four hours each day without any trouble developing.

As the water in the heating element never quite reaches boiling point, the amount of fur forming is likely to be slight and after three months use no loss in efficiency has been noticed.

Steam and air locks do not develop.

Good circulation is ensured by the drawing-off pipe being led from the centre of the heating element and entering the reservoir higher than the return pipes.

Hot water may be drawn off indefinitely provided the reservoir is replenished with cold water as fast as it empties.

As a source of heat, stoves oil wickless and stoves oil boiling have been used with equally good results. The stoves oil boiling are less trouble in use.

The making of the taps is simple nor does the making of the apparatus require any expert knowledge or ability.

If a brass three-way tap is fitted the internal diameter should be $\frac{1}{4}$ inch. Using this tap, cold, lukewarm or hot water may be drawn off, the water circulating as before in the "off" position.

A diagram is produced to assist in understanding the making and working of the apparatus.

AN IMPROVED STERILIZER FOR FIELD MEDICAL UNITS.

BY MAJOR W. M. E. ANDERSON, M.B., B.Ch.

Royal Army Medical Corps.

WITH the equipment available in Field Medical Units the sterilization of large articles, such as kidney dishes, is sometimes a problem and, in an attempt to meet the difficulty, a simple type of sterilizer has been constructed from portions of two four-gallon petrol tins. The necessary work was carried out, on practically a "no-cost" basis, in the fitter's shop of a Field Ambulance Company.

As shown in the photographs, the sterilizer consists of three parts, viz., the box, the lid and the tray, with two hand grips.

(a) The box (fig. 1) consists of a petrol tin from which one side and about one-third of the adjoining ends and sides have been removed and the cut edges turned in for about $\frac{1}{4}$ inch. Four-gallon tins have normally a small

handle at one end and a second handle was soldered on at the other end. The external dimensions of the box are $13\frac{1}{2}$ inches by $9\frac{1}{2}$ inches by $6\frac{1}{2}$ inches.

(b) The lid (fig. 1) was made from the side of another tin, along the edges

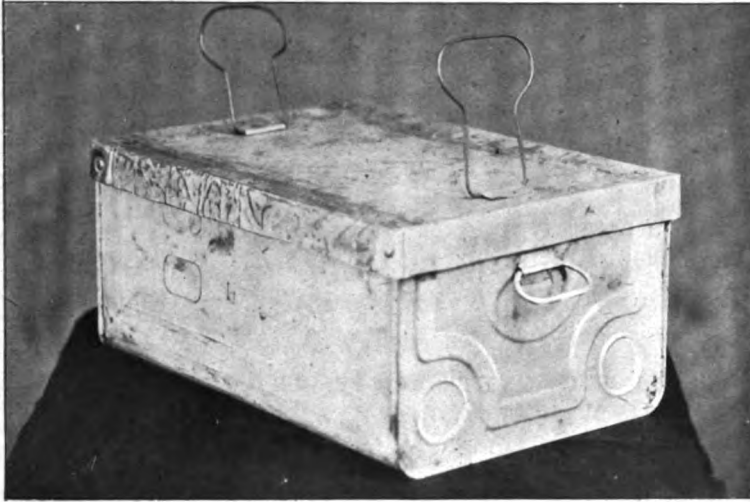


FIG. 1.—Box and Lid.

of which strips of tin, $2\frac{1}{4}$ inches wide, were attached by soldering and secured with eight small rivets, leaving a 1 inch overlay. The free edges were bent over in a $1\frac{1}{4}$ inch flange and each corner joined with solder and a single rivet.

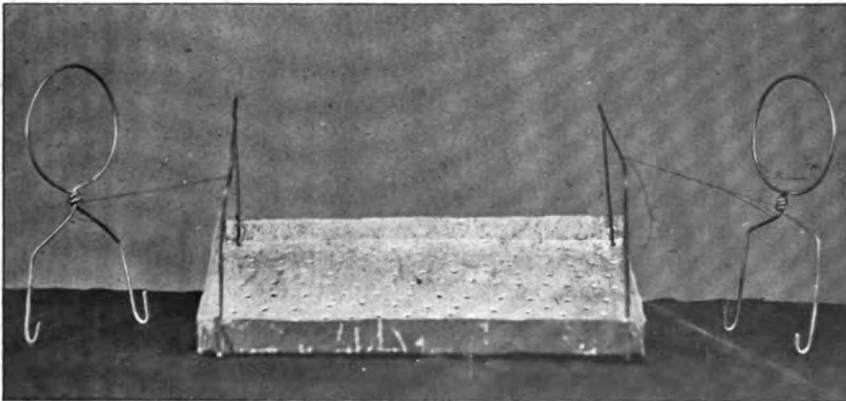


FIG. 2.—Tray and Hand Grips.

The external dimensions of the lid are 14 inches by 10 inches by $1\frac{1}{4}$ inches and it fits very loosely on the box, allowing a good margin for caloric expansion.

(c) The tray (fig. 2) was constructed from the portion of the original tin

which was removed in making the box, the edges being bent up in a 1-inch flange and the corners left unsoldered. About a hundred perforations were made in the base with a $\frac{1}{4}$ -inch punch. The dimensions of the tray are 12 inches by $8\frac{1}{2}$ inches by 1 inch and the wire handles at each end are about 5 inches high. The hand grips of twisted wire, for lifting the tray out of hot water, are about $7\frac{1}{2}$ inches high and 4 inches wide at the base and their circular portion has a diameter of about $3\frac{1}{2}$ inches.

It should be noted that, in the event of the box portion being accidentally burnt out, a new box can be constructed by the fitter in a maximum of ten minutes.

This sterilizer has undergone fairly severe tests and appears capable of standing up to prolonged boiling. In use, each end is supported on three 9-inch bricks, placed side by side and end upwards, which enables a Primus stove to be slipped underneath and removed for filling when necessary.

I have to express my thanks to Lieutenant-Colonel H. B. Trumper, R.A.M.C., for permission to submit this note for publication and to Private F. J. T. Green, R.A.S.C., my Company Fitter, for putting my ideas into concrete form.

THE OIL DRUM GREASE TRAP.

BY MAJOR A. W. STOPFORD THOMPSON,

Royal Army Medical Corps.

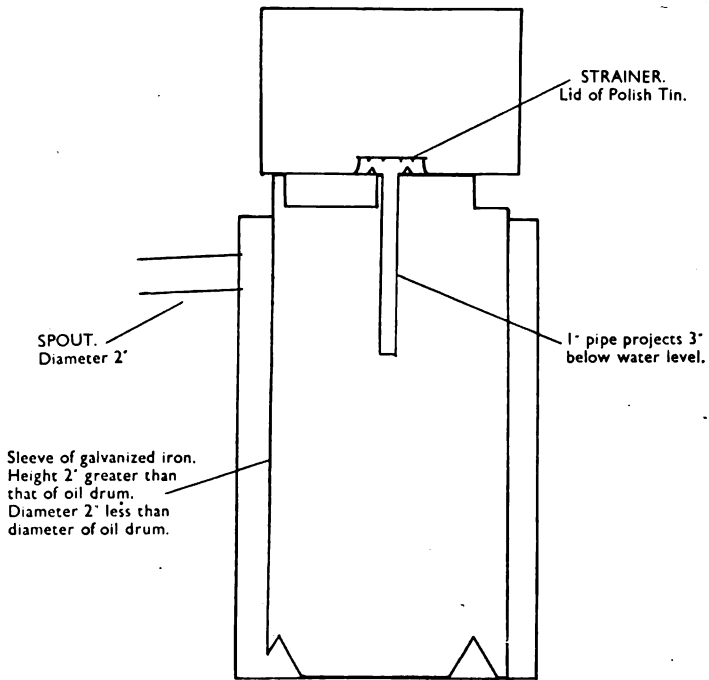
A DIFFICULTY which frequently arises in cook-houses in requisitioned buildings is that standard types of field grease traps are unsuitable for use in a paved yard. The ordinary cold water grease trap, when made with the poor materials available at present, will seldom hold water if it cannot be sunk into the ground. One finds that most units in these circumstances use no grease traps of any kind, with the result that sooner or later the drains become blocked.

The grease trap illustrated in the accompanying sketches is an attempt to overcome this difficulty.

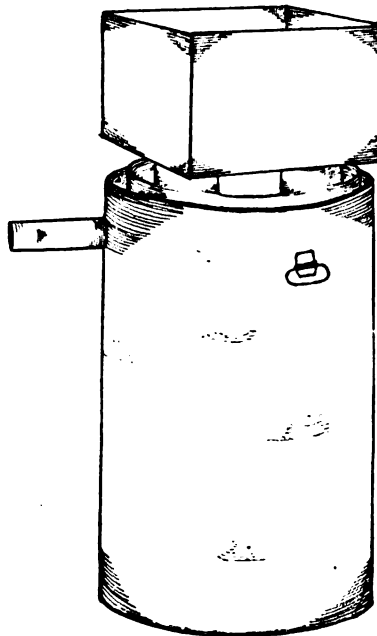
Materials required are a four-gallon petrol tin, half of which becomes the strainer box, the strainer itself being made from the lid of a small tin; a sheet of flat galvanized iron, forming the cylindrical baffle plate; and a five-gallon oil drum. The handles are taken from the petrol tin. In making the baffle plate, it is best to rivet the joint first with three or four nails, and then solder it.

It is unnecessary to use straw or bracken in this grease trap. The object of the narrow tube is to carry the hot water below the grease level. The success of this particular trap depends on its ability to lose heat rapidly, and for this reason it must not be sunk into the ground, and the castellation of the top of the baffle is important.

It has been found in practice to deal satisfactorily with the grease from a cookhouse for forty to sixty men.



Section.



Perspective Drawing.

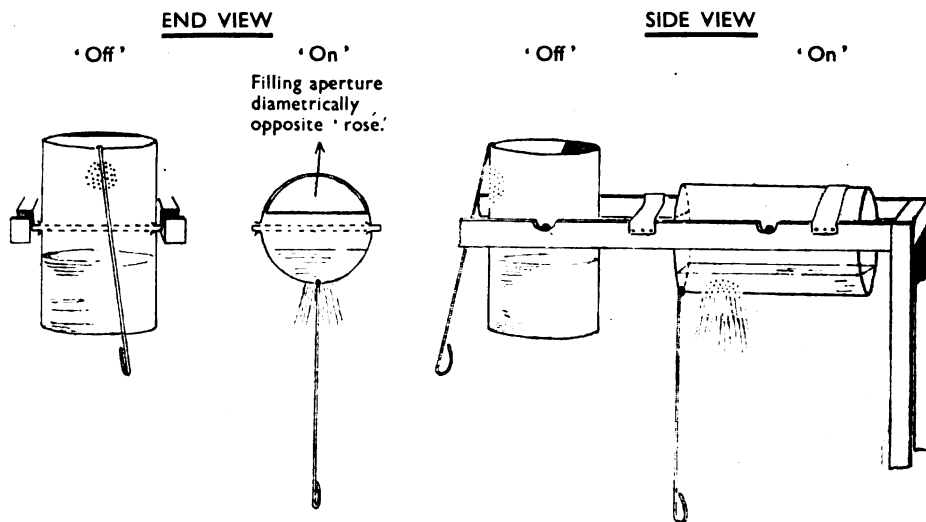
AN IMPROVED SHOWER.

BY MAJOR A. E. TURNER,
Royal Army Medical Corps.

THE simplest form of shower bath is made by perforating the necessary holes in the bottom of a drum but this was found to be impracticable for the following reasons :

- (1) It was found necessary to have some method of turning " off " and " on " the shower to allow the bather time to lather himself.
- (2) It does not permit the man to fill up and fix his shower before undressing.

The following sketches illustrate how a shower bath can be constructed without the use of skilled labour or special tools ; it can be turned " off " and " on " at will and fixed in position before the bather undresses.



The five-gallon oil drum holds $3\frac{1}{2}$ gallons of water up to the pivot and gives a strong shower for three minutes running continuously.

A fire bar is passed through the drum about 1 inch above the centre of gravity and a strip of camouflage tape is tacked on to the supports, as shown in sketch, to prevent the drum from passing beyond the horizontal. This ensures that the shower swings to the " off " position when the handle is released.

These showers can be set up in rows as required. The hot water can be drawn from Soyer stoves or other improvised water heaters in the five-gallon drum which is lifted into position and is then ready for use.

A STEAMER FOR USE WITH THE SOYER STOVE.

BY MAJOR D. A. LOWE,
Royal Army Medical Corps.

AND

LIEUTENANT AND QUARTERMASTER J. B. SABIN,
Royal Army Medical Corps.

AT this time, when economy and fuel is of prime importance, it is thought that a description of a simple steam cooker, at present in use by an R.A.M.C. unit, may be of interest to messing officers and cooks generally.

The steamer is designed for use with the regulation Soyer Stove, is light yet strong, easily cleaned and, in making use of the steam generated in the main container of the stove, allows two items to be cooked at one time. It consists of a round galvanized iron body lipped to fit tightly inside the top of the Soyer Stove. There is a removable lid, two side handles for lifting, and the bottom is perforated to allow the circulation of steam from below.

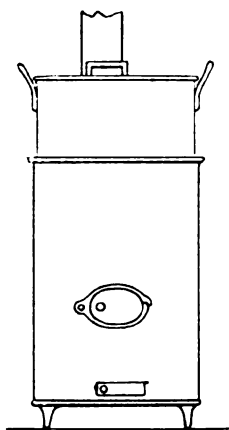


FIG. 1.—Steamer in position.

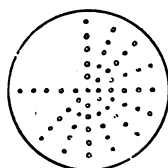


Fig. 2.—Plan of bottom, showing perforations for steam.

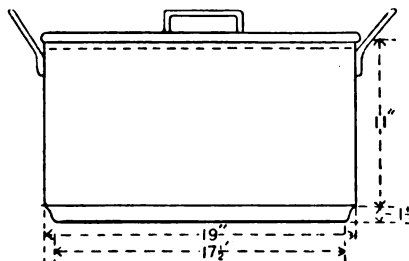


FIG. 3.—Elevation showing detail.

It is capable of cooking 75 to 80 pounds of potatoes or root vegetables in an hour or less, or 60 to 70 pounds of steamed pudding (in suitable containers) in $1\frac{3}{4}$ hours. It has also been found useful for macerating bones in the preparation of stock. The steam liquefies the marrow and loosens the small fragments of meat which fall through the perforations into the liquid below. The cleaned bones, ready for salvage, are left in the steamer.

The steamer was designed by Lieutenant (Quartermaster) J. B. Sabin, R.A.M.C., and was made to specification by Messrs. Newlove of Malton at the cost of £1 8s.

We are indebted to Lieutenant-Colonel J. W. Hyatt, R.A.M.C., for permission to forward these notes.

Current Literature.

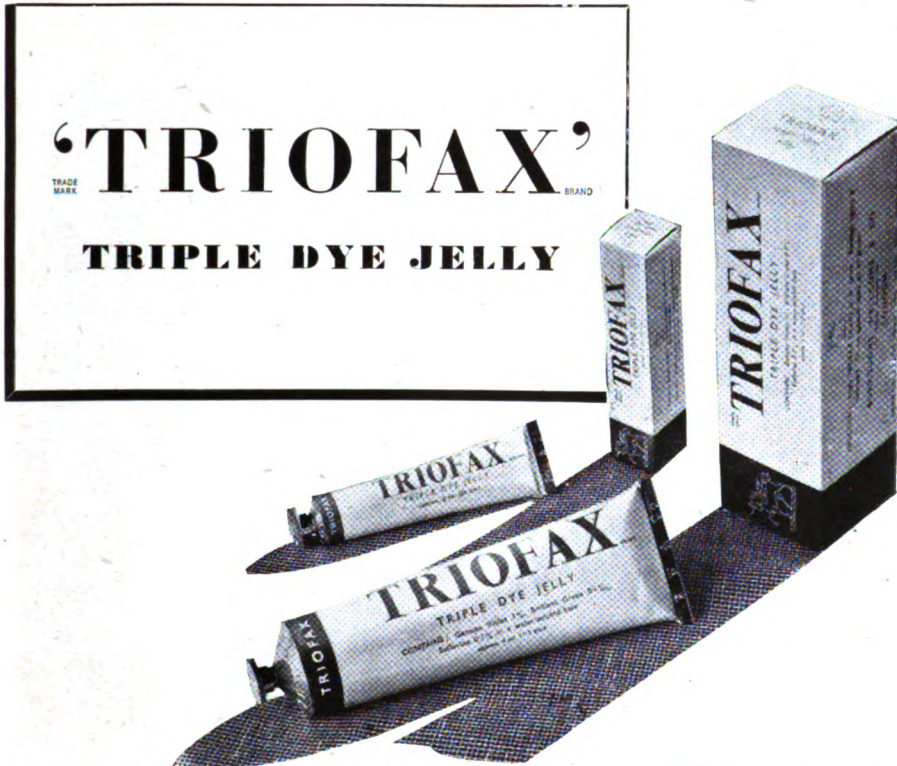
JONES, R. R., CROSSON, J. W., GRIFFITH, F. E., SAYERS, R. R., SCHRENK, H. H. & LEVY, E. **Administration of Pure Oxygen to Compressed Air Workers during Decompression: Prevention of the Occurrence of Severe Compressed Air Illness.** *J. Indust. Hyg. & Toxicol.* 1940, v. 22, 427-44, 5 figs. [22 refs.]

The value of oxygen inhalation during decompression as a prophylactic measure against compressed air illness has been tested. Preliminary experiments established the fact that no untoward effects developed during or after the inhalation of 100 per cent oxygen while undergoing decompression.

It was apparent that the gas could be administered in two ways, one in which there would be a constant flow of oxygen and the other in which the oxygen would be automatically supplied during respiration. The latter was considered the more satisfactory because it would meet a wide variation in oxygen demand and at the same time would be more economical. This principle of automatic administration is used in oxygen breathing apparatus, and some of the parts of this equipment were incorporated in the new apparatus. The first device was designed primarily for the administration of oxygen to a single person, as a therapeutic measure during decompression in a medical lock. This apparatus consisted of a reducing valve and breathing bag with admission valve assembly as used in oxygen breathing apparatus, a long breathing tube and a half-mask face-piece. The device was not used as a closed system and the exhaled air escaped through a valve on the face-piece. This apparatus worked satisfactorily and was used as the basis for the first apparatus built for administering oxygen to twelve persons simultaneously. Oxygen from two 220 cu. ft. cylinders of the gas was led through a reducing valve to a rubber breathing bag assembly. From this the oxygen was conducted through large diameter rubber tubing to a 1½ inch galvanized pipe which served as a manifold in which 12 one-inch nipples were placed. Half-mask face-pieces with exhalation valves were connected through flexible breathing tubes to each of the nipples.

In the experimental group 3,884 decompressions with oxygen inhalation were conducted over a three-month period on groups of 12 men in 3 crews. These men were unselected volunteers and they were carefully instructed and supervised throughout. They breathed pure oxygen during the last twenty minutes of each decompression period. No case of bends occurred in this group during the course of the experiment.

In another group, 15,904 decompressions were performed on men who were in the same crews as those of the experimental group, and who decompressed in the same lock at the same time as the oxygen volunteers, but who did not breathe pure oxygen during the decompression period. There were



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21 cases of compressed air illness in this second batch, giving a rate of 1.32 per 1,000 man-decompressions.

In another series of tests using oxygen, 11,196 decompressions were made but 23 cases of compressed air illness were reported (2.05 per 1,000 man-decompressions). In the same chamber at the same time as those that were supplemented with pure oxygen, 9,462 decompressions were also conducted in the regular manner, and these produced 12 cases of illness (1.27 per 1,000 man-decompressions). This result would appear to deny the value of oxygen inhalation during decompression, but a further review of the individual cases reported showed that the oxygen inhalation was more beneficial than it appeared at first sight. Of the 23 cases of compressed air illness during oxygen inhalation, 3 were discounted, and all but 1 of the remaining 20 cases were mild and were all relieved on decompression. In the group which decompressed in the ordinary manner, however, i.e. without the use of oxygen, 5 of the 12 cases of bends were severe. Another important factor appeared to be that the men in the oxygen group were not carefully instructed and supervised throughout the experimental period.

In two further groups of decompressions without oxygen inhalation, 31,254 decompressions produced 70 cases of compressed air illness, and 18,750 decompressions 34 cases of illness. The rates per 1,000 man-decompressions were 2.24 and 1.81 respectively.

In view of the fact that in the first experimental group, 3,884 decompressions with oxygen were conducted without a single case of compressed air illness, it seems reasonable to assume that, with an efficient system of oxygen administration in addition to proper supervision and education of the worker in the use and necessity for utilizing the apparatus, the incidence of compressed air illness can be considerably reduced and that serious cases can be eliminated.

C. G. WARNER.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 4.

BENJAMIN, B., FLEMING, G. & ROSS, MARY A. **Results of Schick Test in Children One to Ten Years after Injections of Toxoid.** *Amer. J. Dis. Children.* 1940, Dec., v. 60, No. 6, 1304-12. [10 refs.]

The authors traced the persistence of immunity by Schick-testing two to ten years after the injection of diphtheria toxoid. The control injection in the Schick test was made with a 1:100 dilution of toxoid. No Schick tests had been done prior to the original immunization. Two doses of toxoid had been injected into 125 children. These now showed an 18.4 per cent Schick-positive rate, while for 1,370 children who had received three doses the positive rate was 7.0, the obvious indication being that three doses are better than two. The children who had received three doses numbered 1,397 and almost all were available for the various analyses. Amongst 1,251 children the percentage found positive ranged from 4.8 per cent in those tested 1-2 years after immunization, to 7.5 per cent for the 4-5 year group; then the figure rose sharply to 14.9 for the group

inoculated 5-11 years previously. The different groups contained from 150 to 300 children. On this sudden rise is based the suggestion that in the sixth year of life all children should receive 1 c.c. of toxoid, or be Schick-tested and be immunized if positive. There was no material difference in the immunizability of the sexes; 668 boys showed a positive rate of 6.4 per cent while for 617 girls the figure was 7.7. The analysis of results in those inoculated at an early age gives interesting figures; 383 children were from six to nine months old when injected. Fourteen (3.6 per cent) had become positive when tested some years later; this figure compares favourably with the 8.3 per cent amongst 662 who were more than one year old when inoculated. The authors point out that diphtheria is met with in the first year of life and that immunization begun at six months may give as good results as those obtained at later ages. In none of 67 children tested a short time after immunization did the Schick reaction revert to positive in less than two years after the third dose of toxoid.

R. A. O'BRIEN.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 4.

TALBOT, H. P. **Four Years of Premarital Blood Tests.** *Med. Officer.* 1940, Dec. 14, v. 64, No. 24, 201.

The results of the premarital blood tests which have been carried out in Connecticut, U.S.A., in accordance with the law which came into operation in 1936 were as shown in the following table, constructed from one in the original paper:

RESULTS OF THE CONNECTICUT PREMARITAL BLOOD TEST LAW.

	1936	1937	1938	1939
Males reported positive ..	36	59	108	111
Females " " ..	45	53	88	96
	81	112	196	207
Certificate marked non-communicable	37	52	116	145
Marriage not sanctioned ..	44	60	80	62

In the first year of the law the marriage rate fell considerably, but has since recovered, and in 1939 was higher than in any year since 1932. This may account for the larger number of positives found in 1939, but it should be noted that the number of cases in which sanction was withheld did not rise. This is attributed partly to a better understanding of the intention of the law on the part of the medical profession, and to "the suggested protection to the physician and patient by the physician requiring a signed statement from prospective applicants (particularly in young females) that they relieve the physician of responsibility in signing the certificate and agree to remain under treatment as outlined." A significant decrease in reports of cases of congenital syphilis under one year of age is attributed to the pre-

vention of marriage of infectious persons, or to steps to insure their treatment, the numbers of such cases from 1936 to 1939 were respectively 38, 24, 16, and 11. At the end of 1939 the number of States in the U.S.A. which had passed premarital blood tests laws was nineteen.

L. W. HARRISON.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 4.

MUIR, E. **Some Basic Principles in Leprosy Treatment.** *Leprosy Review.* 1940, Oct., v. 11, No. 4, 162-169.

After emphasizing the high resistance of the tissues with intense cellular reaction in nerve cases, compared with the absence of resistance in the lepromatous type, the author states that in the latter type the two objectives are to strengthen and stimulate the tissue cells to act more vigorously in breaking down the defence of the bacilli. These principles are the basis of his oft-recommended measures to improve the general health by regular exercise, etc. Local applications of caustics, such as trichloroacetic acid, intradermal injections of hydnocarpus oil, the exact action of which is not fully understood, and nutritious diet are also advised. Potassium iodide, in small doses at first, is stated to have a specific effect in breaking down the defence mechanism of the bacilli. Fluoresceine in 10 grain doses daily for seven months, methylene blue, 4 grains for six months, or trypan blue, 4 grains for over one month, are also recommended, but he does not advise massive doses of these dyes.

L. R.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, No. 4.

CAPON, P. J. L. **A Brief Investigation regarding the Height above Sea-level at which Malaria occurs in Baluchistan.** *Jl. Malaria Inst. of India.* 1940, June, v. 3, No. 1, 125-127.

An outbreak of malaria occurred among British troops encamped at Kahan Tangi in Baluchistan, 6,500 feet above sea-level. Previously it was thought that the altitude precluded the possibility of malaria transmission. The author made an inquiry in a number of villages situated at heights varying from 6,200 to 8,000 feet; spleen examinations were made and sick persons were examined. It would appear that in this region malaria transmission ceases at a height of about 7,000 feet.

N. W.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, No. 4.

MUIR, E. **Intranasal Treatment in Leprosy.** *Leprosy Review.* 1940, Oct., v. 11, No. 4, 173-175.

The author advises (1) mild antiseptic treatment on the lines recommended by Parkinson, namely irrigation of the nasal cavities with normal saline with the aid of a pipette while the patient lies sideways on a couch. If there is much nasal catarrh 0.9 per cent ephedrine hydrochloride should be added to the saline. (2) If there is severe sepsis with pus and

crusts, the same treatment is advised with longer retention of the saline to soften the crusts, or sodium sulphate may be used up to 10 per cent strength. (3) For dealing with leproma, cauterization with trichloroacetic solution is advised in a 10 per cent solution after the mucous membrane has been anaesthetized with a spray of 2 per cent novocain, and repeated after two weeks. Treatment diminishes the discharge of lepra bacilli from the nose.

L. R.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, No. 4.

HERTIG, MARSHALL. Glass Tubes for Rearing Phlebotomus and Other Insects. *Science*. 1940, July 26, v. 92, No. 2378, 91-92. With 1 fig.

"All methods of rearing sandflies in the laboratory involve keeping the engorged females at a high degree of humidity in a vessel with a moist inner surface on which the eggs may be laid." The authors fill one end of a tube (of length 8 cm. and bore 8 to 9 mm.) with plaster of Paris, which extends into the tube for 10 to 12 mm. The open end is stoppered with cotton. These tubes may be made in quantity by standing bundles of cut tubing in dishes of freshly mixed plaster. Before use the plaster is moistened by contact with wet cotton and when containing sandflies the tubes are stored, plaster end down, in moist earthen pots or in pans with a thick bottom layer of plaster. The highest degree of moisture short of condensation on the glass walls is desired. Eggs may be immersed in water and transferred to a breeding pot by pipette.

These tubes may also be used as containers for transporting sandflies and for the breeding of fleas.

C. W.

Reprinted from "Tropical Diseases Bulletin," Vol. 38, No. 4.

Reviews.

NEURO-OPHTHALMOLOGY. By L. Lindsay Rea, B.Sc., M.D., M.Ch., F.R.C.S.
Second Edition. London: W. Heinemann (Medical Books), Ltd.
1941. Pp. 688 with 196 illustrations and 22 colour plates. Price 50s.

The second edition of Lindsay Rea's *Neuro-Ophthalmology* adopts the rather unusual procedure of incorporating the additions to the subject-matter in the Second Edition as an appendix of 110 pages at the end of the original edition. The absence of any omissions from the first edition makes the second much bulkier, a tendency which, if the plan is persevered with in subsequent editions, will have obviously inconvenient results. Moreover, it is annoying, after reading a section in the main body of the book, to find at the end that the information there laboriously absorbed is wrong and out of date. Neither section—the new or the old—is thus complete and, while cross reference may be possible at this stage, it is to be hoped that in later editions the author will re-write the original sections which have

become obsolete with the passage of time. Apart from this there is some repetition in the book and small discrepancies : for example, it is disturbing to be told on one page that papillœdema should not be confused with optic neuritis only to find that the author commits this mistake on another page.

On the whole, however, the volume is full of valuable information both for the ophthalmologist and the neurologist and, although one would have preferred more decided views in an authoritative textbook on some subjects such as the valuelessness of excision of the cervical sympathetic for pigmentary degeneration of the retina, it fills a considerable want in the literature. The book is well produced, excellently illustrated and among its valuable features not least are the bibliographies.

FOOD VALUES IN WAR TIME. By Violet G. Plimmer. London : Longmans, Green & Co. 1941. Pp. 80. Price 1s. net.

The balanced diet and its scientific basis ; good and bad feeding habits in the past ; experience in the War of 1914-18 ; present-day food problems and their solution.

About these matters Mrs. Plimmer writes in a manner which will interest and instruct and we recommend this booklet as more than a popular discussion of a subject which is of national importance at the present time.

A. E. C.

THE EARLY TREATMENT OF WAR WOUNDS. By William Anderson, *O.B.E.*, *M.B.*, *Ch.B.*, *F.R.C.S.* Oxford University Press. London : Humphrey Milford. 1941. Pp. viii + 89. Price 5s. net.

This little book is based largely upon experience gained in the 1914-1918 war and it is as well, in our ready acceptance of modern methods, not to forget the lessons learnt in those not far distant days. It is safe to assume, however, that even younger men, working in air-blitzed cities, have already had to deal with problems and circumstances more difficult even than those of the "dimly lighted dug-out dressing station, the dust, the mud, the noise, the crowds of wounded, the appalling wounds, etc.," portrayed by the author.

The book, however, contains information which will prove of value to the youthful medical officer bound for operation areas where war is war as it used to be.

SURGERY OF MODERN WARFARE. Parts I to V. Edited by Hamilton Bailey, *F.R.C.S.* Edinburgh : E. & S. Livingstone. 1941.

Compiled by sixty-five contributors. Issued in five parts, now obtainable in one bound volume with title page, preface, list of contributors, contents, and comprehensive index, 8vo, 928 pp., with 828 illustrations, many of which are in colour. Price 75s. net. Part I : Section I, Wounds, General Considerations ; Section II, Wounds, Special Considerations.

Part II : Section II continued ; Section III, Wounds of the Trunk ; Section IV, Wounds of the Blood-vessels. Part III : Section IV continued ; Section V, Peripheral Nerve Injuries and Wounds of Tendons ; Section VI, Methods of Immobilizing the Limbs ; Section VII, Wounds of the Hand and Foot ; Section VIII, Wounds of the Bones and Joints. Part IV : Section VIII continued ; Section IX, Wounds of the Face and Neck, including those of the Special Senses. Part V : Section IX continued ; Section X, Wounds of the Central Nervous System and its Coverings ; Section XI, Surgical Diseases encountered in the Subtropical Countries ; Section XII, Administration ; Section XIII, Appendix.

The method of publishing this work in five consecutive parts has much to commend it, particularly as the parts are small and can be conveniently read. The reader would have been happier had two of the volumes not ended in the middle of sentences.

The editor, contributors, and publishers are to be congratulated on the result of their labours. The task of editing the articles of sixty-five authors has been exceedingly well done. The contributors, each a recognized authority, have written articles which are terse but not dogmatic. The contributions are almost without exception comprehensive and stimulating. The publication has been exceedingly well laid out, the illustrations are of uniform fine quality and the print is most readable.

Of special note are the sections and articles dealing with Tetanus, Tendon Suture, Intestinal Injuries, Wounds of the Blood-vessels, and Wounds of Bones and Joints. The section on Wounds of the Face and Neck and Special Senses is excellent and most timely. Plaster technique and methods of splinting the limbs are extremely well described. Extension in a Thomas' splint by means of a boot calliper has not been mentioned in spite of its being such an improvement on other methods.

Much valuable work in the field of traumatic surgery and the repair of injured organs has been accomplished since the outbreak of this war and the greater part is here recorded. The stimulating effect of these excellent articles will undoubtedly appeal to all surgeons and they will give an invaluable impetus to future investigation and achievement.

Notice.

"CELLONA" PLASTER CASTS.

MESSRS. T. J. SMITH & NEPHEW, LTD., of Neptune Street, Hull, have again sent us particulars of their 18 inch, 24 inch and 36 inch widths of "Cellona" material with details as to the use of these in application. We are much struck with these "Cellona" plasters and particularly with the "Spinal Jacket" described on page 18 of this booklet. They offer this work free to surgeons who may be interested in their excellent technique.

Authors are alone responsible for the statements
made and the opinions expressed in their papers.

Journal of the Royal Army Medical Corps.

Original Communications.

MEMORANDUM ON WAR SURGERY AT THE
53RD GENERAL HOSPITAL, SUDAN.
JANUARY 1941—APRIL 1941.

BY MAJOR R. STUPPELL, F.R.C.S.,
Royal Army Medical Corps.

FOREWORD.

HERE is an article which cannot fail to be of interest, to surgeons in particular, especially when it is appreciated that it is written by a young surgeon who worked alone in a somewhat isolated small base general hospital, the establishment of which carries but one surgical team. Major Stuppell, obviously, has had sound surgical training together with some experience in traumatic surgery as seen in civil practice and here you will find described in a frank and interesting manner his reactions to the problems connected with the treatment of the first battle casualties he had to deal with. His cases reached him four days after being wounded so that he could make little use of the many valuable communications to the medical press on the early treatment of wounds which have appeared since the war started and he had, rather, to work out his own lines in treatment. It is possible to follow his reasoning and to appreciate his reactions. Others who have had to face or may still face such problems will surely find this article useful and instructive.

A few passing comments may not be out of place and it is believed that such will in no way detract from the excellence and value of the memorandum.

It is noteworthy that in this series of 311 cases, 43 were complicated by fracture. This gives a percentage of 13·8, which is exactly the same figure as reported in an analysis of 200,000 wounds in the Great War.

The 53rd General Hospital was a long way behind the fighting line at that time and it is not surprising that no abdominal cases reached it ; those which had not already succumbed were obviously retained in medical units nearer the line. The terrain over which the fighting was taking place at that time was an exceedingly difficult one but supplies of sulphonamide were available and it is a matter for surprise that it was not freely used as was the case in the Western Desert.

The points the writer makes on free drainage and adequate immobilization are worthy of note but surely as much credit, if not more, is due to Winnett Orr as to Trueta in this respect ?

It is suggested that small repeated whole blood transfusions, rather than serum alone, would have been better for the anæmia which accompanies large weeping wounds. -

X-ray Apparatus.—Supplies of apparatus are now available. The policy in this Command, and one based on the experience of many disappointing if not tragic results, has always been to discourage primary suture unless the case is dealt with really early and under suitable conditions.

Air replacement after aspiration of a hæmothorax. In my opinion 500 c.c. is rather a large amount.

D. C. MONRO, *Colonel*
(*Consultant Surgeon, Middle East*).

I.

OUR first battle casualties arrived on January 20, and we ceased working on April 8, so that our records cover a period of eleven weeks.

During that time 311 casualties were admitted and 285 operations were performed upon them.

It took approximately four days for casualties to reach us from the front line, at first through a C.C.S. and later through a General Hospital in addition.

The majority of wounds were due to splinters of metal in the lower limb followed, next in order of frequency, by similar wounds in the upper limb.

Wounds in the lower limb were complicated by a fracture of the femur in three cases ; by fracture of the tibia and/or fibula in eight ; by fracture of the bones of the foot in five and by a penetrating injury of the knee-joint in three.

Wounds of the upper limb were associated with fracture of the humerus in eight cases, of the radius and/or ulna in six and of the bones of the wrist and hand in seven.

The spinal cord was injured in three cases, the skull in six, large blood-vessels in two, important peripheral nerves in four, and the chest was perforated in seven cases. No perforating wound of the abdomen reached us.

Five deaths occurred. Two were in Italian Prisoners of War who were admitted in a condition of impending dissolution. One had been shot in the head and survived for only half an hour after admission. The other had an open pneumothorax and lived for two hours after admission. These cases may reasonably be excluded from our figures, producing a mortality rate of 1 per cent for all admissions. The three fatal cases will be described in detail in their respective sections later.

The first cases to arrive had been dressed and roughly splinted but no surgical treatment had been carried out. A large proportion of them had been given sulphonamide by mouth for periods varying from one to three days but we never received any patients whose wounds had been treated by local sulphonamide pack nor did I ever try this line of treatment myself.

Later in the campaign we began to receive cases which had had early excision of the wound but I cannot recall more than three or four who did not require further attention to the wound, such as *débridement* or excision of necrotic tissue.

Almost all the wounds, when we received them, were infected and the patients febrile on admission. Those who had fractures were in pain because of the incomplete immobilization of the bone fragments in inadequate splints in the early stages of the campaign but, later, cases began to arrive in plaster casts and these were strikingly free from discomfort.

When our first convoy arrived—it was in the evening—they were at once given pre-medication and taken to the theatre that night, so that the theatre staff worked during the whole of the night until the following morning.

I subsequently realized that this expedition was unnecessary and future cases were left for the night, with a sedative if necessary, and dealt with on the following morning.

As a matter of fact, most of the casualties were so tired and exhausted on admission after travelling for about four days that they fell asleep as soon as they were put to bed.

I can recall only one case which really needed immediate treatment on admission and that was a patient whose anterior tibial artery had been shot through and who began to bleed afresh.

We saw no case of gas gangrene or tetanus. Every wounded man on admission was given 3,000 units of A.T.S. if there was no record on his card of his having already received it.

II.

The wounds with which we had to deal fell into four groups:

(1) Through and through bullet wounds with a small point of entry and exit—of the “leech bite” type.

(2) Through and through splinter wounds with a small point of entry and a large ragged point of exit.

(3) Perforating splinter wounds with a minute point of entry and a large lacerated cavity within the limb, out of all proportion to the size of the wound on the skin.

(4) Lacerated tangential wounds with considerable destruction of tissue.

In wounds of the first group, two possibilities might arise: (a) They might be practically sterile and heal almost by first intention with very little systemic disturbance or (b) the bullet track might be filled with blood-clot. In this event, if the blood was not evacuated early, after a few days the hæmatoma became infected and the wound painful with a general febrile reaction. In these cases it was sufficient to draw a piece of gauze through the track and so clear out the old blood clot. The wound then settled down and healed well.

The closed plaster method was almost universally employed for wounds of the limbs after a preliminary *débridement*.

In the early cases the wound was lightly packed with vaselined ribbon gauze which had been previously prepared and sterilized on the spools and, where there was a wound of entry and exit, a piece of gauze was pulled through from one wound to the other, with the idea of encouraging drainage to the surface.

The whole limb was then encased in an unpadded plaster cast.

In the case of the lower limb, the cast included the whole of the foot as far as the web of the toes on the dorsum and beyond the toes on the plantar aspect. If the plaster is not extended to these limits the limb is certain to develop œdema where it is not supported by the cast.

It was found that these cases did quite well for a while and then began to develop a low-grade pyrexia. Upon removing the plaster, the gauze packing was found to be acting as a plug and the wound was full of pent up pus. The temperature subsided when the packing was removed and a fresh plaster applied.

I then asked myself what purpose was served by the vaseline gauze pack and, as I could find no satisfactory answer, I no longer put gauze or any other foreign body into the wound but contented myself merely by covering the surface of the wound with a layer of sterile vaseline gauze to protect it from the plaster cast.

The original purpose of packing the wound with gauze was apparently to keep it open so that the skin would not unite before the base of the cavity was healed. But, in those wounds with which I had to deal, there was usually so much loss of skin that this possibility could not arise and, furthermore, the natural elasticity of the skin tended to keep the wound open rather than allow it to close too soon.

I never used antiseptics of any kind in the wound. Prior to excising and exploring the wound I shaved the skin around and painted it with iodine but, apart from that, I was guided by the principle enunciated as long ago as 1887 by Gamgee, who said that "the question is not one of antiseptics or no antiseptics but of the form and proportions in which they should be employed in particular conditions. The great antiseptic is Life. The living tissues have a natural preservative power which, if guarded and conserved by the surgeon on physiological principles, offers the surest guarantee

for healthy repair which is only an adaptation and extension of normal nutrition."

Apart from one fatal case, the post-mortem findings in which are recorded later, all the wounds did uniformly well.

Two cases, one a splinter wound of the buttock and the other a traversing wound of the thigh, I did not at first put into plaster but contented myself with *débridement* only, merely covering the wounds with a sterile dressing and a soft bandage.

In a couple of days there was a spreading infection into the cellular tissues underneath the skin. A plaster cast was applied, and in both cases the immobility of the tissues so produced brought about an immediate cessation of the inflammatory process and the condition rapidly subsided.

This completely confirmed the views of Trueta (1939) of the paramount importance of immobility in preventing the spread of bacteria along the lymphatic channels.

Foreign bodies, if they were readily accessible, were removed but, if they were difficult of access, they were left.

During the rush periods, some cases which had a small foreign body retained and a wound which was reasonably clean and small were left over. These nearly always developed infection later and had subsequently to be opened up and the foreign body removed.

I found that wounds that were thoroughly opened up and thus permitted free drainage, *provided they were adequately immobilized*, almost invariably progressed smoothly and healed with much greater rapidity than one is accustomed to expect, taking as the usual standard the rate of healing in non-immobilized tissues.

Not only did the wound heal more rapidly but the infection very quickly became localized, all signs of inflammation in the surrounding area subsided, and the oedema, redness and pain disappeared.

There was a profuse discharge of pus in all cases, the amount appearing to depend on the degree of infection which was present at the time of the *débridement* of the wound.

I always excised as freely as possible all necrotic and injured tissue but I did not spend an excessively prolonged time in attempting to remove every particle of infected material which in practice appears to be an unattainable ideal. I relied however upon free and adequate drainage.

If the temperature did not subside within three or four days or if, having subsided, it rose again, the plaster cast was removed and the source of the temperature elevation investigated.

It was usual to find that there was a pocket of pus present, where the infection had tracked up into one of the cellular spaces at the periphery of the wound, and this was dealt with by incising the overlying skin so that the pocket was laid open and thus provided with adequate facilities for free drainage. The plaster cast was then re-applied.

Occasionally the patient complained of burning pain under the plaster.

This was due to excoriation of the skin where there was a free flow of pus over it. It could in a large measure be prevented by smearing the skin with vaseline all around the wound before putting on the plaster.

In spite of adequate *débridement* the application of a closed plaster cast might occasionally fail to produce the usual fall of temperature and it was then necessary to review the case and consider the possible cause of the persistent pyrexia.

Patients who have been evacuated from tropical Africa frequently suffer from metazoal infections and these had to be excluded. But in my experience the most likely cause of the persistent pyrexia was wound infection. As a matter of practical politics it is sound policy to investigate this possibility first. Actually, I was never able to demonstrate malarial parasites in the blood of patients who had been wounded in Eritrea and who were admitted as battle casualties.

In our series of cases of gunshot wounds of the limbs there was one death. This man illustrated in a striking way the clinical features of such a case which proceeds to a fatal termination.

He was a German prisoner of war and had been hit in both legs by machine gun bullets which had tunnelled the shaft of the tibia on one side and scored the surface of the bone on the other.

The wounds of entry and exit were small and appeared comparatively clean. The skin edges were excised, a gauze wick introduced into the wounds for the purpose of drainage, and both limbs were encased in plaster.

He was febrile on admission and his temperature did not subside. Because of this, a week later, one of the plaster casts was removed and the wound inspected. The swelling of the limb had subsided and the wound looked reasonably clean. There was not a great discharge of pus. The plaster was re-applied.

He was given M & B 693 with no fall in his temperature; sulphanilamide was equally unsuccessful.

He subsequently developed septicæmia with the following clinical signs: persistent swinging temperature, variable pulse-rate within wide limits, a progressive anæmia, marked wasting, diarrhoea, an enlarged spleen and enlarged liver and signs of congestion at the base of the right lung.

In view of the comparatively trivial nature of his wounds, the profound systemic disturbance which he showed was considered as possibly due to a concomitant metazoal or other infection, and the following conditions were considered: malaria, amœbic dysentery with hepatitis, typhoid and finally septicæmia.

All the laboratory tests were negative. The enlarged liver with signs at the right base was suggestive of hepatitis but actually the chest signs were due to a septic infarct.

At post-mortem examination, the bullet wounds in the legs were seen to be in an unhealthy condition with no evidence of reaction. There was a localized osteitis around the track of the bullets. Unfortunately it was not possible to obtain a culture of the organisms present in the wounds.

One learnt the following lessons from this case :

(1) In traversing wounds of the limbs it may be necessary to open up the whole of the track in order to provide adequate drainage.

(2) If the temperature does not fall to normal within three or four days after the application of the plaster the latter must be removed and the condition of the wound investigated.

Normally, following *débridement* and the application of a plaster cast, the temperature rises to 102° or 103° Fahrenheit, but it quickly settles and should show no further rise.

It sometimes happens that a patient does not respond so well or so quickly as one would like. In this event, a *blood-count* is of paramount interest and significance.

Facilities for the identification of the infecting organism may not be readily available but an examination of the blood can usually be carried out without much difficulty.

A severely wounded man may not be bleeding when he arrives at the base hospital but one must not forget that he must, of necessity, have lost a considerable quantity of blood when he received his wound. The continued loss of serum from a large surface, as well as prolonged suppuration, even in the absence of hæmolytic organisms, invariably leads to a progressive anæmia, and it is most important to be on the watch for the suspicious pallor which these patients show.

A blood-count will throw a flood of light on the situation and will indicate the appropriate line of treatment.

We had one case, with a very extensive splinter wound of the buttock, which well illustrated these points.

The wound had been excised and encased in a plaster spica at the C.C.S. Owing to the extensive loss of skin over the buttock, a wide area of tissue was laid bare, and a seepage of blood-stained serum continued for several days. This ceased, and was replaced by a fairly profuse discharge of pus.

The temperature was 100° F. on admission, and continued to oscillate between 99° and 100° F. for many days. The plaster was twice removed in an effort to find some pocket of pus that would account for the persistence of the temperature. But the wound was rapidly filling in with granulation tissue and the surface, within a fortnight, was almost flush with the surrounding skin. The granulations were healthy and there was no sign of serious infection.

A blood-count, however, revealed that the hæmoglobin was only 40 per cent of normal, and a white cell count showed a high polymorphonuclear leucocytosis.

These facts gave the clue to the appropriate line of attack ; a drip blood transfusion of 1,000 c.c., augmented by sulphapyridine by mouth brought the colour to his cheeks and the temperature to normal.

There may be an important place in the treatment of these cases for transfusion with dried plasma or serum but I had no opportunity of trying them.

In the early phases of the campaign we gave sulphonamide more or less as a routine to all infected cases but I subsequently found that adequate surgical treatment of the wound, with complete immobilization, was sufficient in the great majority of cases and I came to reserve sulphanilamide and sulphapyridine for resistant cases such as the one which I have just described.

III.—FRACTURES.

We dealt with thirty-six compound fractures made up as follows :

Femur	3
Tibia and Fibula	7
Tarsus and Metatarsus	5
Humerus	8
Radius and Ulna	7
Carpus and Metacarpus	6

Every compound fracture that arrived at this hospital was infected although in the majority of cases the degree of infection was not serious. In the early stages of the fighting the patients were admitted febrile and, frequently, in considerable pain from incomplete immobilization of the fractured bone ; but later cases were dealt with at the forward units and the limb encased in plaster casts. These patients were strikingly free from discomfort.

I formed the opinion that the views I have already expressed with regard to packing the wound with gauze, or leaving it open and merely applying a layer of vaseline gauze over the surface of the wound to protect it from the plaster, apply even more strongly to compound fractures than to wounds involving the soft tissues only. I could see no justification for putting into the wound foreign material which served more to prevent than encourage drainage.

It is necessary to protect the wound from the plaster cast, however, not so much for the sake of sterility but because, unless the vigorous young granulation tissue is held back by an impermeable dressing, it tends to grow into the interstices of the plaster bandages and is very painful when the plaster is removed.

Where *débridement* was necessary prior to the application of the plaster there was always a sharp rise of temperature to 102° or 103° F. but it fell to normal in three or four days.

Fractures of the shaft of the humerus were immobilized in a plaster abduction frame with the whole limb, including the shoulder-joint, included in the case. It was found that the U-shaped plaster slab that one uses for simple fractures of the shaft of the humerus was insufficient to provide adequate immobilization for these comminuted infected fractures with which we had to deal. Abduction of the arm was maintained by means of a Cramer wire splint, suitably bent, and incorporated in the plaster.

The degree of abduction, forward flexion and external rotation of the arm necessary for anatomical reduction of the fracture varied with the level.

Watson Jones (1940) says that generally the best position is one of forty degrees abduction and thirty degrees forward flexion.

With the patient anaesthetized and lying on his back it was somewhat difficult to be sure that the limb was held in the correct position while the plaster was hardening and it was found that the procedure was rendered considerably easier if the plaster was put on in such a way that each joint was immobilized in turn, starting at the shoulder.

A simple and satisfactory rule for obtaining the position recommended by Watson Jones is to hold the arm in such a position that the thumb of the injured limb is in a vertical line with the patient's nose, with the elbow at a right angle.

These comminuted fractures of the shaft of the humerus may take a very long time to unite and it is important to refrain from removing the plaster before X-ray evidence shows that there is firm consolidation of the callus. In any event, the union must be tested clinically when the plaster is removed and, if there is any doubt about the result, the plaster must be re-applied for a further period. Failing this, the callus already laid down will be absorbed and permanent non-union may result.

Two of our cases of fractured humerus were complicated by injury to the musculo-spiral nerve. In these cases the plaster on the forearm was extended into the palm so as to cock up the wrist.

When this requires to be done the plaster in the palm must extend sufficiently far forward to fix the metacarpo-phalangeal joints so that extension of the fingers can be carried out by means of the lumbrical and dorsal interossei muscles. If this is not done, extension of the fingers is impossible.

Fractures of the shafts of both bones of the forearm, especially in the upper third, are exposed to the risk of cross union.

Such a case was sent to us with the arm already in plaster. The patient had a very severe lacerated wound of the upper third of the forearm with an associated fracture of both the radius and ulna. The limb had been put up in the position mid-way between pronation and supination with the elbow flexed to a right angle.

We were able to X-ray the patient about three weeks after the original wound. By that time cross union had occurred.

Wounds of the forearm, with fracture of both bones in the upper third, should be put up in the fully supinated position to overcome the pronation of the lower radial fragment and further precaution against cross union should be taken by making the plaster cast oval in section instead of circular or by inserting wooden pegs between the two bones—over a layer of plaster.

Whenever plaster was applied to the hand great care was taken to see that the plaster did not extend beyond the proximal crease in the palm; that the plaster bandage extending over the web between the thumb and index finger was not too bulky and that the plaster was well cut away from the dorsal aspect of the first metacarpal so that all the fingers except the

one injured had free movement. It was found that fingers that were not thus adequately cared for very rapidly became stiff. For the same reason, any finger that had to be immobilized was always put up in the flexed position so that the movement of the other fingers was not interfered with.

Compound fracture of the femur accounted for three of our cases. One was per-trochanteric and the remaining two through the shaft. They were dealt with on the Böhler traction apparatus.

A steel pin was first thrust through the tibial tuberosity, and traction was then made on the limb until the measurements from the anterior superior iliac spine to the internal malleolus were equal on both sides.

X-ray apparatus was not available so we had to rely for the first attempt at reduction on clinical judgment. In practice, this is not so serious a handicap as might be supposed since, when strong traction is made on the limb in the Böhler apparatus, any gross deformity of the femur is automatically reduced and any tendency to backward bowing of the shaft of the bone can be corrected while the plaster is still soft by suspending the cast by means of a broad bandage from the vertical frame which forms part of the apparatus.

With the limb extended on the frame the wound was dealt with, any completely loose fragments of bone being lifted out. The wound was then covered with a layer of vaseline gauze and plaster applied to the whole limb from the pelvis to the toes incorporating the pin in the tibia. In one of the cases it was deemed advisable to include the sound thigh in the plaster spica but, in the remaining two, only one hip was immobilized, the sound limb being left free.

Following this treatment the patient was taken off the frame when the plaster was dry and, as soon as he was fit—in a few days time—sent for X-ray for confirmation of the position of the fracture. X-ray examination was now of course a simple matter since the patient was completely mobile.

The per-trochanteric fracture was anatomically reduced and required no further manipulation. The wound in the second case was so extensive that it had been possible to impact the ends of the two fragments manually. In the third case, a badly comminuted fracture of the lower third of the shaft of the femur, there was some backward angulation. This was readily corrected by sawing through half the circumference of the plaster on the dorsal aspect opposite the angulation, correcting the angulation, and then filling in the wedge so formed with fresh plaster.

IV.—WOUNDS OF BLOOD-VESSELS.

Two cases presented injury to an important blood-vessel as the outstanding lesion.

In one the anterior tibial artery was shot through immediately in front of the ankle. This was the only case which required urgent treatment on admission to hospital. There was a recurrence of the primary hæmorrhage

just after he arrived and the vessel required to be ligated. He made an uninterrupted recovery.

In the second case a bullet had traversed the lower third of the arm, from the lateral to the medial side, grazing the chest wall as it escaped. The brachial artery was severed as the missile traversed the arm and the median nerve was bruised at the same time but no other important structures were damaged.

On admission three days later, the patient presented a pulsatile swelling in the lower third of the arm and an absent radial pulse. The circulation in the periphery of the limb was satisfactory and there was no loss of movement or anæsthesia of the hand or fingers.

In view of the apparently quiescent state of the wound, it was treated conservatively for three days. By that time, however, œdema began to appear higher up the arm, and the limb was painful.

Through a longitudinal incision the deep fascia was incised and blood-clot turned out of the lacerated brachialis muscle. The two cut ends of the brachial artery were found without much difficulty and ligated and the wound was closed with a small drain under the skin. Apart from a mild infection along the suture line the patient made an uninterrupted recovery. Slight tingling over the skin area of the fingers supplied by the median nerve still persisted when he was evacuated.

The treatment of this case followed the lines recommended by Sir G. H. Makins but actually nothing was gained by delaying the exposure and ligature of the torn vessel and it seems likely that the infection which developed might have been diminished if the hæmatoma had been cleared out earlier.

V.—WOUNDS OF PERIPHERAL NERVES.

Four cases presented nerve lesions as an important feature of the injury. Two cases of fractured humerus were complicated by a lesion of the musculospiral nerve and one case of fracture of the radius showed the features of a lesion of the posterior interosseus nerve.

Since all these cases were several days old when they reached us, and were already infected, no attempt was made at suture of the nerve. The only special provision was the inclusion of a cock-up in the plaster cast.

It might have been wiser to have exposed the damaged nerve and perhaps tethered the ends together, if they were divided, but as these cases were subsequently evacuated I lost sight of them and I cannot say what the condition of the nerve will be when the wound is healed, the fracture united and the plaster removed.

One patient had been shot through the popliteal fossa from the lateral to the medial side. The wounds were small and clean—of the “leech bite” type—but when he arrived at this hospital, three days after the injury, he was already in considerable pain.

The wound itself did not trouble him but the painful area corresponded

to the distribution of the long saphenous nerve and later spread to that of the internal popliteal.

An injection of novocain into the long saphenous nerve as it lay over the medial aspect of the knee-joint produced immediate relief which, however, was only temporary.

The skin over the inner side of the leg and foot became hyperæsthetic and developed a punctate erythematous rash. He could not bear the bed-clothes to touch his leg and his condition became pitiable.

The popliteal fossa was exposed through a midline longitudinal incision, and the internal popliteal and long saphenous nerves were found to be involved in dense scar tissue which had formed along the track of the bullet.

The nerves were freed, and the patient's symptoms gradually began to disappear. A week after the operation he was considerably relieved but whether the relief continued I cannot say because he was evacuated at that time.

VI.—INJURIES OF THE SKULL.

We dealt with six serious injuries of the skull with one death. The points of interest which were brought out were :

(1) A deceptively small and innocent-looking external wound may be associated with a fracture of the cranium and the retention of a missile within the cranial cavity. For this reason it is essential to X-ray every injury of the skull. Failing the means of radiography, every skull wound ought to be explored.

One case arrived from the C.C.S. with a small wound on the forehead which had been excised and sutured. The day following admission, the patient developed meningeal symptoms.

Exploration of the wound revealed a fractured skull with a lacerated dura. He recovered following drainage and massive doses of sulphonamide and subsequent X-ray examination revealed the presence of a minute fragment of metal deeply situated within the cranial cavity.

(2) Primary suture of wounds of the scalp under field conditions, like primary suture of wounds in other soft tissues, is a dangerous procedure and is very likely to be followed by spreading infection which is rendered all the more precarious if there is an associated but unrecognized fracture of the skull.

Two cases arrived which had been primarily sutured. They were both infected and had œdema of the upper part of the face. Removal of the sutures and free drainage was followed by improvement.

(3) Very considerable damage may have been inflicted on the contents of the skull with no visible signs of external injury.

One patient—the fatal case—was admitted with multiple wounds, including a superficial searing wound of the cheek.

His condition appeared to be reasonably satisfactory for about a week when he developed signs of an intra-cranial lesion.

He died quite suddenly and post-mortem examination revealed a massive sub-dural hæmorrhage. He had been wounded by a nearby shell burst but he could not remember the details of the incident and no exact information was forthcoming.

(4) The intense headache which may be a late result of blows to the head may be greatly relieved, and the condition of the patient much improved, by the administration of a saturated solution of magnesium sulphate in water *per rectum*. It is best given very slowly by means of a drip apparatus.

One of our cases had been struck on the head by a splinter of shell. He was fortunately wearing his steel helmet at the time and this was smashed but it saved his skull from serious damage, the only injury that he sustained externally being a superficial wound over the mastoid process.

About a week after the injury he began to complain of very severe headache.

X-ray examination failed to disclose the presence of a fractured skull but there was blood in the cerebrospinal fluid.

He was nursed with his head elevated and magnesium sulphate solution was given in a rectal drip. His headache rapidly disappeared and the whole syndrome subsided.

VII.—PENETRATING WOUNDS OF THE CHEST.

We dealt with seven penetrating wounds of the chest with one death. Our series of cases fell into three groups :

(1) Traversing wounds with a small point of entry and exit, and no demonstrable hæmothorax.

(2) Traversing wounds with a closed hæmothorax.

(3) Penetrating wounds with an open pneumo-hæmothorax.

Cases in the first group presented the clinical picture of pneumonia, with the characteristic rusty sputum, etc., and they did very well under purely medical treatment with M & B 693.

Those in the second group, which included one fatal case, were less satisfactory. They were treated by repeated aspiration of blood from the pleural cavity and replacement with air. In three cases, the hæmothorax became infected and had to be drained by rib resection. These recovered but only after a fairly stormy convalescence.

The third group presented the same complications as the second with the added difficulty and danger of the sucking wound which had to be closed.

The details of the fatal case are as follows :

According to the Field Card he was received at the C.C.S. on the day that he was wounded in a very distressed condition.

Twenty-six ounces of blood were aspirated from his chest, with relief of his dyspnoea.

On the following day, he was passed on to the next hospital, where a

further 350 c.c. of blood were aspirated, and this time replaced by 100 c.c. of air.

He arrived at this hospital seven days after he had been wounded. He was collapsed with a subnormal temperature and a rapid pulse. He had a massive hæmothorax on the left side with small closed wounds of entry and exit.

He was left undisturbed for three days, when his temperature began to rise, and it was considered advisable to aspirate some of the contents of his pleural cavity.

450 c.c. of blood were withdrawn and 500 c.c. of air were introduced in its place by means of an artificial pneumothorax apparatus.

The intrapleural pressure recorded before the aspiration was commenced was plus six centimetres of water, with no respiratory excursion. Following the aspiration of blood and its replacement with air the manometer showed an excursion of several centimetres but the mean intrapleural pressure was the same. His immediate condition improved and he was less distressed.

Six hours later, he became distressed again with a rapid pulse-rate, but he gradually improved and by the following morning he was considerably better. A few hours later, however, he collapsed and died.

Post-mortem examination revealed the following features :

The left pleural cavity was three-quarters full of blood. The lung was completely collapsed. The bullet had fractured a rib at its point of entry, tunnelled its way through the upper lobe of the lung from the periphery to close to the hilum, and fractured another rib at its point of exit.

The pleura, where the blood had been in contact with it, was covered with a fairly heavy deposit of dark red fibrinous material which had obviously been deposited from the blood. It was fairly adherent to the pleura. This deposit ceased abruptly along a horizontal line which corresponded to the fluid level in the chest and, above this level, the pleura was normal in appearance.

The heart and pericardium were displaced markedly to the right but otherwise showed no abnormality. The right pleural cavity and its contents appeared to be normal.

The conclusions which I drew from a study of these penetrating wounds of the chest were as follows :

(1) Cases without demonstrable hæmothorax, but showing clinical signs of pneumococcal pneumonia, should be treated medically. They respond very well to M & B 693. It may be that a low-grade pneumococcus is the invading organism.

(2) Cases with a closed hæmothorax present a problem which has not been completely solved. If these cases are left without aspiration two unpleasant sequelæ may develop : (a) they may become infected—in fact they are very prone to do so ; (b) the deposit which was seen post mortem

will tend to bind the lung down in its collapsed condition and interfere with its subsequent expansion.

On the other hand, if aspiration is carried out too early, there is a very serious risk of encouraging further hæmorrhage and this does not appear to be completely guarded against even when the blood withdrawn is replaced by an equal quantity of air.

(3) Closed suction drainage of an infected hæmothorax may be improvised by means of a Dakin funnel.

The opening at the top is fitted with a rubber stopper through which a hole has been bored and a short piece of glass tubing fitted. To the lower end of the funnel is attached a piece of rubber tubing and a screw clamp. The apparatus is fastened to the side of the bed.

If now the funnel is filled with water and the drainage tube from the chest attached to the connexion at the top of the funnel, when the screw clamp is opened so that the contents of the funnel escape drop by drop into a receiver, a negative pressure will be created which is communicated to the pleural space.

The rubber tubing from the lower end of the funnel should end below the surface of the water in the receiver as otherwise air tends to enter the funnel and the suction is diminished.

(4) Following rib resection and closed drainage, a time comes when the empyema cavity is localized and a short drainage tube may be introduced into the chest and the discharge allowed to escape into the dressing on the chest wall.

These cases heal up much more rapidly if the patient is allowed up since by this means expansion of the lung is encouraged and the empyema cavity more quickly obliterated.

It is a universally accepted surgical teaching that every penetrating wound should be explored, hæmorrhage arrested and damaged tissue excised and there is no reason why chest wounds should be excluded from this basic principle.

Schrire (1940) reports a series of stab wounds of the chest in which immediate thoracotomy was carried out with universally satisfactory results.

I think that the answer to this problem of hæmothorax is that these cases should have been submitted to immediate thoracotomy.

The reason why we are faced with these unhappy dilemmas in dealing with chest wounds which are presented to us a week old is that, at that stage, we have to "make the best of a bad job."

VIII.—SUMMARY.

A brief description is given of the cases with which the Surgical Division of the 53rd General Hospital had to deal during ten weeks of the fighting in Eritrea.

The campaign was characterized by difficult country from which the wounded had to be evacuated and the considerable distances over which they had to be transported.

The striking absence of gas gangrene is noted. The closed plaster treatment of wounds was completely vindicated. The treatment of fractured femurs in plaster with a pin through the tibial tuberosity solved the problem of mobility of the wounded man and some views on the problem of penetrating wounds of the chest are expressed.

REFERENCES.

- GAMGEE (1887). Quoted by OGILVIE, in "War Primer on Wound Infection," 1941, *Lancet*, London.
- MAKINS, Sir G. H. Official Medical History of the War, ii, pp. 170-290.
- SCHRIRE (1940). *Brit. Med. Journ.*, ii, 662.
- TRUETA (1939). "The Treatment of War Wounds and Fractures," London.
- WATSON-JONES (1940). "Fractures and Other Bone and Joint Injuries," Livingstone, Edinburgh.
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THE TREATMENT OF ABDOMINAL WOUNDS.^{1 2}

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THE surgery of abdominal wounds has an importance beyond its operative implications. It is important in the morale of an army, for fighting men dread wounds of the abdomen and are fortified by their unexpected recovery. It is important as an index of the efficiency of the military-medical machine, for the survival rate depends on timing, placing, and equipment, on selection, pre-operative care and post-operative nursing, hardly at all on slick surgery.

In wounds of the limbs, we are concerned chiefly with forestalling infection by prophylactic surgical excision; in the abdomen, wound infection is less important, or at any rate overshadowed by the risk of damage to internal organs. Gas gangrene is above all a complication of shell wounds involving large muscle masses such as the thigh, the buttock and the shoulder; in the abdominal wall it is rare, and not usually dangerous.

Thus the surgery of abdominal wounds has a certain similarity to the surgery of abdominal trauma in peace time, the chief difference being that it cannot be reduced to rules. Any organ or combination of organs can be damaged in any way, and by wounds that are often not apparently abdominal at all. Injury to abdominal viscera is often combined with injury to the lung or to the hip-joint. The wound of entry may be in some distant part of the body, it may be inconspicuous, and it may be quite unknown to the patient.

Gordon Taylor relates the case of a soldier who was standing by his horse well behind the front line, when he was suddenly seized with severe pain in the epigastrium. He presented the complete clinical picture of a duodenal perforation, and at operation a perforation was found in the usual situation, the only unusual thing being the presence of blood in the peritoneal cavity. The hole was closed and the man improved, but the next day suddenly got worse and died. At the post-mortem a machine-gun bullet was found in the posterior duodenal wall, its point embedded in the pancreas. The entry wound was a tiny puncture in the right supraspinous fossa. The first point I would make, therefore, is that everybody who handles the wounded, and particularly the sorting officer at a C.C.S., must be on the look-out for abdominal injuries, even in cases that are not labelled as such.

In the days when the long rifle bullet was the chief missile of warfare, many men with abdominal wounds recovered spontaneously. A few did

¹A paper read before the Kenya Branch of the British Medical Association, May 6, 1941.

²Reprinted by permission from *The East African Medical Journal*, June 1941, 18, 67.

so in the last war and some, with tangential wounds involving solid organs only, may still be expected to survive. But in modern warfare we must regard every man who is wounded in the abdominal cavity as certain to die unless he is operated upon and as likely to die unless he is operated on early. On the other hand, if he survives, his prospects of enjoying a normal and useful life are better than those of the man with serious injury to the head, face or limbs. For both reasons, the urgency of operation, and the satisfactory prospects it offers if successful, cases of abdominal injury demand special consideration. In any unit the sorting officer must set them aside as cases demanding urgent attention and probable surgery and in certain conditions it may be wise to devote special teams or even special hospitals to their care. Operation within six hours of injury is necessary if any but a small proportion are to survive and the attainment of this ideal is largely a matter of administration, and of arranging to bring the patient to the surgeon or the surgeon to the patient within that period. In a warfare as highly mechanized as that of to-day this problem may be easier than it was in the last war, provided that the equipment is kept simple. Safety now lies in concealment rather than in distance, so that abdominal centres can often be sent right forward. But it is not merely a matter of pushing up mobile operating teams. A man with an abdominal wound may require careful investigation, he is likely to need some resuscitation before operation, he may want transfusion during it, and he is very unlikely to survive unless he can be carefully nursed for a week afterwards before he is transported. The arrangement and equipment of a unit must, therefore, bear this in mind.

The investigation of a case admitted as an abdominal injury must be brief and purposeful and there is no place for intricate pathology or for balancing the philosophies of higher diagnosis. The surgeon has to answer four questions :

- (1) Is this an abdominal injury ?
- (2) If so what structures are injured ?
- (3) Does that injury necessarily demand operation ?
- (4) If operation is advisable, can the patient stand it, now, or at all ?

Bearing in mind what has been said about penetrations of the abdomen by minute particles, and by projectiles entering the body at some distant point, it is essential to regard every case presenting abdominal symptoms as an abdominal wound till it has been proved to be otherwise. Four groups are likely to cause difficulty; thoracic wounds, spinal lesions, abdominal contusions and blast injuries.

Thoracic wounds are often accompanied by considerable abdominal pain and rigidity, the abdominal symptoms perhaps overshadowing those in the chest. The decision as to whether the wound is abdomino-thoracic or purely thoracic is important, for in the first case operation is urgently necessary, in the second it can be and sometimes should be postponed. The main points of distinction are that in purely thoracic wounds the rigidity is strictly unilateral, whereas in abdominal wounds it is total, or limited to

Abdominal Wounds

genital wounds involving solid organs. But in modern warfare we must consider the abdominal cavity as certain to lead to death unless the patient is operated on early. The prospects of enjoying a normal life after a man with serious injury to the abdomen are a matter of urgency of operation, and the size of the wound. In cases of abdominal injury demanding operation, the operating officer must set them apart from those requiring no operation and probable surgery and in certain cases special teams or even special hospitals are necessary. The attainment of this ideal is largely a matter of bringing the patient to the operating table as early as possible. In a warfare as highly mechanized as the present, it is no longer so easy as it was in the last war. Safety now lies in concealment. Operating centres can often be sent right up to the front. The idea of pushing up mobile operating centres may require careful investigation. Before operation, he may want to know whether he can survive unless he can be carefully transported. The arrangements for transport must be kept in mind. As an abdominal injury must be operated on early, the search for intricate pathology or for a definite diagnosis is. The surgeon has to answer the question: Can the patient stand it, now, or at all?

operation? The penetrations of the abdomen into the body at some distant point may be otherwise. Four groups of abdominal lesions, abdominal contusions, are by considerable abdominal wounds overshadowing those in the thorax and is abdomino-thoracic or thoraco-abdominal. In such a case operation is urgently required. Sometimes should be postponed. In thoracic wounds the rigidity of the chest is total, or limited to



certain peritoneal compartments rather than to one side ; that the rigidity is variable, often lessening as the patient's attention is distracted, and tending to disappear rather than to increase ; that purely alimentary symptoms such as vomiting and distension are absent, and that the general condition of the patient tends to improve unless there is an open pneumothorax or progressive bleeding, when the distinction is less important, operation being necessary in any case. Spinal injuries may also mimic abdominal injuries, causing referred abdominal pain and sometimes rigidity also. When these symptoms are the only ones noted, and the patient is collapsed, the signs of cord involvement may escape notice. It is, however, important to test the sensation and movement of the legs when the track of the projectile passes near the spine, since an abdominal operation on a paralysed patient is useless, and a useless operation is a crime against the man whose turn comes next.

The possibility of infra-abdominal injury accompanying wounds or contusions that are apparently limited to the abdominal wall must always be borne in mind. Tears of the spleen and liver, rupture of the jejunum, ileum or duodenum may occur in men injured by explosions no less than in those involved in civil accidents. When the abdominal wall has been injured, shock, localized tenderness and localized guarding will always be found : but if the injury is purely parietal the shock will rapidly decrease with rest and warmth, and the tenderness and guarding will diminish or at most remain stationary. A rising pulse, the discovery of tenderness at some fresh site such as the bottom of Douglas' Pouch, and a tendency for the guarding to involve uninjured areas of the abdominal wall, these mean intra-abdominal mischief and demand laparotomy. Attention must also be drawn to "blast abdomen," a condition found in patients subjected to a sudden increase in the pressure of their surroundings, as when a shell or bomb explodes within 30 feet of them, or a mine or depth charge is detonated in the sea near where they are swimming. These patients present the picture of acute general peritonitis, such as that seen with a perforation. They are collapsed, in great pain and their abdominal wall has a board-like rigidity. Sometimes there is actual rupture of the gut, but more often laparotomy or post-mortem discloses multiple sub-peritoneal hæmorrhages all over the abdomen. The distinction can only be made by careful observation, the patient being given morphia and kept warm and still, and a half-hourly chart of the pulse being kept. Auscultation is an invaluable method of investigation in all these doubtful abdominal injuries and should never be omitted. A silent abdomen is an abdomen in need of laparotomy.

Where there is a wound, the need for operation is usually apparent and further investigation is a waste of time. In through and through wounds the direction of the track joining the two openings will give a very fair indication of the viscera that are probably damaged. In tangential wounds protrusion of omentum or bowel, or the escape of intestinal contents or of blood welling out with the movements of the diaphragm, will show the nature

of the injury and indicate the need for operation. In single wounds, however, an estimate of the direction of the track is difficult without knowledge of where the retained foreign body lies. Here an X-ray is invaluable, but rapid screening or a single film is usually all that is required and no exact localization should be attempted. The information is required to enable the track of the wound to be visualized rather than to help in a search for the foreign body, a search which would in any case be guided by points of attachment, vascular pedicles and peritoneal compartments, rather than by surface markings.

An estimate of the course of the projectile will guide two decisions, whether operation is necessary and what incisions should be used. In most cases operation is necessary and should be done as soon as possible, but where the liver or kidney appear to be the only organs involved and there is no severe bleeding, its scope should be limited to excision of the outer part of the track and the establishment of drainage. When it is known that visceral injury is limited to the neighbourhood of a wound in the parietes, it is usually best to approach the abdomen through that wound; if on the other hand the damage involves distant structures, a laparotomy incision is needed.

The best time for operation is the earliest at which the patient can stand it. All men with abdominal wounds are to some extent shocked, and the majority will be better for a short period devoted to resuscitation before being taken to the theatre. This period must be actively supervised and anxiously watched by a responsible officer, for while shock is being overcome vessels are also bleeding and torn viscera discharging their contents into the peritoneum. There is one "best" moment for operation in every abdominal wound and it must be seized, for it will never come again. The shock is compounded of many elements—mere physical exhaustion, pain, dehydration from sweating, plasma loss, and actual shortage of water intake during the fighting; loss of blood and toxæmia from early infection. The administration of morphine, the restoration of body heat by cradles, and the mechanical assistance of circulation by tilting the bed are essential.¹ Fluids may be given by the rectum if the large intestine is known to be undamaged, or intravenously to such cases as are not bleeding. If blood is still being lost, fluid should be withheld till the patient is actually on the table and the loss can be controlled, unless conditions and the supply of blood or plasma permit administration by the continuous drip method.

Two hours is usually the maximum period that can be allowed for resuscitation, and a much shorter one should be aimed at. If a patient is not then fit for operation, he never will be. Only too often the extent or nature of a man's abdominal injuries, or the presence of wounds elsewhere that are incompatible with life, stamp the case as hopeless from the start. It is

¹ The foot of the bed must not be raised if there is already evidence of free fluid in the peritoneum.

unfair to others to waste on the dying time that might save their lives. In other cases it may be necessary to abandon an operation when its futility has become obvious. Only in exceptional circumstances, and when there is no other call on the theatre and ward personnel, can a hopeless operation be justified on humanitarian grounds. On the other hand everything must be done for the comfort of these dying men and they should be kept apart from the less seriously wounded who are awaiting operation.

Little need be said of the circumstances of an operation on an abdominal wound. Of the theatre it need only be mentioned that its equipment must be of the simplest or it will not be transportable to the place where it ought to be, but a good light, a table that can give the Trendelenburg position if required, and some sort of a suction apparatus, are essential; of the anaesthetic, that spinal anaesthesia is anathema under conditions of war, and that gas and oxygen with local infiltration of the abdominal wall is probably the best, with warm ether a good second; of the surgeon that he must be able to make decisions, to work quickly, and to stand long hours.

The patient has wounds already, and these should be excised as part of the surgical toilet, but this excision is second in importance to the intra-abdominal procedures. If the injured viscera are not put right the patient will certainly die; if the wounds are not excised they may go septic, but with chemotherapy the sepsis may not be severe. If some of the wounds are on the back, or in places that cannot be reached from the position of exploration, they should be dealt with first, for every unnecessary movement should be avoided after laparotomy. In many cases the original wound can, after excision, be enlarged for approach to the abdominal cavity; to do so saves time, and saves damage to the abdominal wall, and, therefore, lessens the risk of post-operative pulmonary collapse and embolic vascular complications. If, therefore, the wound is so situated that it can be enlarged without damaging important structures and if the injured viscera are known to be in its neighbourhood, this course should be adopted. If the wound is not suitable for enlargement, or if the visceral damage is distant or widespread, a separate laparotomy incision should be employed. Thus where there is a wound in the flank penetrating the colon and kidney but nothing else, the whole operation may be done through the original wound; where there is a wound of the buttock penetrating the bladder and rectum, the entry wound should be excised down to the bony pelvis and packed with vaseline gauze, and the bladder and rectum should then be repaired through a midline infra-umbilical incision. A wound near the midline anteriorly may be excised and enlarged in the vertical direction, and one in the flank may be extended transversely inwards, or obliquely into the iliac fossa, but those in the intermediate areas cannot be enlarged sufficiently for any but local inspection without doing unnecessary damage. The standard incisions for exploring the abdomen are the right and left para-median, which may be high or low and extended as required, and the midline infra-umbilical incision which is better for approach to the pelvis and less traumatic than a

really low paramedian.¹ The upper abdominal median approach, the best of all incisions for planned gastric surgery in peace time, is liable to give way after suture when used in conditions of infection. Other incisions, such as transverse and the right and left subcostal incisions (Kocher) have, in my opinion at any rate, no place in the surgery of abdominal wounds.

Before examining the abdominal contents, it is wise to make a small nick in the peritoneum at the lower end of the incision, in order to note the nature of the free fluid in the abdomen, whether it is blood or intestinal contents, and its amount. If there is much, the head of the table should be raised about 15 degrees, and the nozzle of a sucker pushed down into the pelvis to draw off the excess. As soon as fluid ceases to flow freely, the abdomen is opened, and the affected part is rapidly overhauled. Hæmorrhage is the chief cause of death in abdominal wounds and should be dealt with first; peritonitis is a secondary and later danger. When the abdomen is full of blood, the most likely sources are the mesentery of the small intestine, and the solid organs, the liver, spleen, kidney and pancreas. These should be examined in order, and the hæmorrhage should be arrested completely, or, in the case of the liver and pancreas, as well as possible, before any attempt is made to repair the hollow organs. As soon as it is under control, transfusion should be started.²

After the arrest of hæmorrhage, the next step is the discovery and repair of all perforations in the alimentary tract through which leakage of contents may take place. In most wounds the area of possible damage is already known, and that part will be investigated first, but the search must not be abandoned nor any repair put in hand till all the organs that may have been injured have been examined, and all the injuries have been recorded and considered together. The small intestine is the part most frequently injured, and will, therefore, be examined first in a general laparotomy, the coils in the line of the track being first overhauled. When a perforation is found, it is marked by clipping a pair of forceps across the extreme edges, and the intestine is rapidly gone over up and down from this point. Each

¹In war surgery the old-fashioned paramedian incision, which cuts through all structures in the same plane half an inch lateral to the midline, is probably better than the rectus retracting incision that is favoured by most surgeons to-day. It saves some time, some dissection, and some ligatures, but more important, it avoids opening tissue spaces to infection and heals better. Theoretically it should paralyse the strip of rectus that lies medial to it, but no weakness is ever demonstrated afterwards. The low muscle retracting incision when used for the removal of a suppurative appendix is often followed by what can only be described as an abscess of the rectus sheath and complete breakdown of the wound, whereas a muscle splitting incision will heal well under the same circumstances. This important practical detail is part of American surgical tradition, but it does not appear to be appreciated by British surgeons.

²The use of fine silk or linen thread for ligatures has many advantages. These materials are cheap and easily sterilized, and enough for a large operation can be carried in a single reel. They bite firmly into the tissues and their knots cannot come untied, so that a job of hæmorrhage, once done, can be forgotten. Catgut ligatures on the other hand are very prone to slip and catgut knots to come adrift when the part is subsequently handled, leading to loss of blood that the patient can ill-spare, and to subperitoneal or mesenteric hæmatomas that obscure the outline of parts to be repaired.

lesion as it is discovered is marked with forceps, and each coil is returned to the abdomen, with forceps attached, as soon as it has been examined. It must be remembered that what goes in goes out, in other words that one large slit may represent the track through the bowel at that point but one small hole must always be paired with another. The holes may be very small, they cannot be recognized by touch, and if they are on the mesenteric border they cannot easily be seen, but they must all be found or an otherwise successful operation may be brought to failure by one tiny omission. After the small intestine, the stomach, colon and solid viscera should be examined by touch and vision, the abdominal wall being lifted up on a broad retractor and a portable light brought into play if necessary. Any retroperitoneal hæmatoma requires careful investigation, for it is often the sign of damage to the kidney or of the much more serious posterior perforation of the fixed portion of the colon.

When all lesions have been tabulated, and this takes much less time to do than to discuss, they must be repaired, a step that can only be considered regionally, since the method to be adopted varies from organ to organ. The repair finished the abdominal cavity is quickly mopped clean, and rinsed with warm flavine solution if there has been much soiling. Sulphathiazole powder dusted over the surface provides an additional safeguard. Any retained foreign body will almost certainly have been encountered and removed during the investigation of the track, but no time should be wasted in looking for it. If it has not been found, the usual reasons are that it is small, in which case it is unlikely to do any harm, or that it is lying outside the abdomen, usually in some large muscle mass, in which situation it will either remain encapsuled or betray its presence at a later date by exciting a localized abscess.

Finally the abdomen is closed with or without drainage. Both Gordon Taylor and Jolly dislike drainage but my own advice, admittedly based on a smaller experience, would be to drain when in doubt. So many of the hæmostases are not 100 per cent secure, so many of the sutures are done to a time limit rather than to a standard, so many of the tissues concerned in hæmostasis and repair have not the vitality of healthy ones, that I feel this extra precaution is wise. A fresh hæmorrhage is recognized at once if there is a drain, and a failed suture leaks to the surface instead of bursting into the peritoneum. I would, therefore, give my personal advice about drainage under three headings. Always drain the extra-peritoneal spaces and the outer layers of the original wounds, and drain the peritoneal cavity not for present soiling but for trouble expected at a stump or suture line in the next few days. Use vaseline gauze as drainage material and not rubber tubes. And having drained do not be in a hurry to undrain; there are two good times to remove a drain, twenty-four hours and ten days.

In discussing points of technique concerning the injuries of particular organs, the didactic method is used to save time rather than to imply that the advice has any higher authority than the opinion of the writer. Injuries

of the small intestine are much the commonest and, because this part of the gut is massed in such complicated coils, multiple perforations are the rule. They are usually small, the mucous membrane pouts through them and, because of this pouting and the immobility that follows injury, they often do not leak for many hours, and may even seal themselves. Perforations of the small intestine should always be closed by local suture if possible. It is unnecessary to trim the edges, and a single purse string or a single layer of interrupted invaginating sutures is usually sufficient. Resection of gut is required when conditions make simple suture mechanically unsatisfactory, as when a group of holes occurs so close together that their repair would overlap and deform the gut, when so many injuries are found in a given segment that resection of the whole would save valuable time, or when the injury is on the mesenteric border. Resection is also necessary where the viability of a portion of gut is destroyed, by crushing, by thrombosis of the vessels, or by detachment of the mesentery for an inch or more. End to end junction is best, and a single layer of interrupted sutures with occasional extra ones to reinforce invagination is quicker and safer than two continuous layers.

Wounds of the colon are less common, and less often multiple, for the colon runs a simple course except in its pelvic portion. On the other hand they are much more serious.

- (1) Because they are often retro-peritoneal, and therefore easily overlooked.
- (2) Because simple perforation is uncommon, and extensive damage, bruising; infarction of vessels, and rupture of the outer coats, is the rule.
- (3) Because the contents escape earlier and in greater quantities than from a small intestine perforation.
- (4) Because these contents are highly infective, and usually contain anaerobic gas forming organisms.
- (5) Because retro-peritoneal cellulitis, often an anaerobic infection, is a common and very fatal complication.

Small perforations in the colon should be looked for with great care, whenever the direction of the track makes them at all likely. Those in the fixed portions of the colon, and on the mesenteric aspect of the transverse colon are particularly liable to escape detection, and a hæmatoma in the mesocolon or in the right or left paracolic gutters should always call for a minute investigation of the adjacent bowel wall.

Holes in the free portions of the colon may be closed by a purse string suture if the bowel wall round them is perfectly healthy, but in most cases a local repair is unsafe and resection is wise. A free mobilization is often required before the resected ends can be brought together without tension. Nearly all writers on military surgery advise end to end suture after resection, with or without cæcostomy, but this advice is unsound in the light of modern teaching and practice, and the high mortality in colon wounds in all pub-

lished statistics suggests that it is not good treatment.¹ After mobilization sufficient to allow the colon above and below the injury to be approximated without tension, the injured segment should be removed, and the cut ends above and below it, closed with crushing clamps, should be brought to the surface at one end of the incision or wound. The clamps are removed after twenty-four hours, and the continuity of the bowel is restored later by crushing the spur between the openings.

Wounds of the stomach are in themselves benign and, were it not that they are so often associated with injury to adjacent structures, would offer a good prognosis. The stomach itself is very viable, and its contents are usually sterile. Wounds of the body and fundus can be closed by a double layer of sutures. Those of the lesser curve require ligation of the vessels and dissection of the bruised lesser omentum before repair. Injuries near the pylorus may present greater difficulties, because their closure obstructs the narrow lumen at this point and a gastro-jejunostomy is required. Wounds of the duodenum, which must almost necessarily implicate the pancreas, common bile duct, portal vessels, vena cava or hilum of the kidney, are usually fatal.

The liver may suffer all sorts of injuries, from tunnelled holes to complete disintegration, with very few of which it is possible to deal surgically. If no other viscus is involved and bleeding is not severe, surgery is not called for. If a liver wound is bleeding, or if it is encountered as part of an abdominal wound, it should be cleansed as far as possible of blood-clot and liver fragments and pressure applied to the surface. For a wound of moderate size Jolly advises that a series of sutures of medium catgut should be passed through the liver wall well away from the wound edge with a blunt needle, and tied over the free edge of the omentum, which is laid in the gap. With larger wounds a gauze roll may be packed into the cavity and brought out at the surface, to be removed a week later. If the upper surface is implicated in a chest wound, it may be packed through the enlarged wound in the diaphragm, which itself is stitched to the skin.

The spleen, if involved in the track of a projectile, is usually split extensively. Bleeding may cease spontaneously or be controlled by suture, but

¹There has been a marked tendency in recent years to look on the large intestine with increasing respect or even fear. Its walls are thin, their blood-supply is poor, and the peritoneal coat is interrupted by a broad mesentery and distorted by fat blisters, the contents are highly infective and mechanically traumatic, its luminal pressure alters with explosive suddenness. No sutures can be placed accurately in its wall, and what are thought to be lemberts often pass through all coats and carry infection. All surgeons have experienced trouble with leakage and sepsis at the suture line after resection, and many feel to-day that no stitch should ever be put through a colon that is not both empty and sterile. A colostomy or a resected loop should not be stitched to the skin but the skin opening should be made to fit the colostomy; a segment of bowel should not be excised and the ends sutured unless the contents have been diverted above by an excluding colostomy for at least two weeks. Devine has shown the way to success in cancer of the colon by his operation of exclusion and Lahey has made resection of the rectum for cancer and of the colon for ulcerative colitis safe by stage operations in which the bowel is brought to the surface. In war-injuries the way to safety is the same, for cæcostomy provides only partial relief of tension at the injured site, and proximal colostomy is no better unless it is done some weeks before.

is very liable to restart. Splenectomy is, therefore, advisable in every case.

The stomach, the liver and the spleen are the organs most commonly involved in thoraco-abdominal wounds; next in frequency come the colonic flexures and the upper coils of jejunum. The chief problem presented by these wounds, which involve the lower thoracic and upper abdominal structures with the diaphragm between them, is that of approach, whether it shall be by thoracotomy or by a laparotomy incision. No rule can be laid down, and the decision will be governed by the site and direction of the wound track and by the extent and nature of the abdominal and thoracic injuries, the last consideration usually being the deciding one. If there is extensive damage to the chest wall, particularly if there is an open blowing laceration, the chest wound takes priority. Gross damage to the lung, progressive intrapleural bleeding, or a large diaphragmatic laceration, will all point to the need for thoracotomy. After the intrathoracic damage has been dealt with and the pleura mopped dry, the diaphragmatic wound is trimmed and enlarged if necessary in a radial direction. Through such an opening injuries of the stomach colon or upper jejunum can be repaired easily, and the spleen can be removed; on the right side a laceration of the dome of the liver can be plugged. The diaphragm must be repaired with a double row of sutures and the chest wall closed in an air-tight manner, the pleura being drained by a de Pezzer catheter inserted through an intercostal space. Should the abdomen require draining, this should be done through a separate stab below the diaphragm. If on the other hand the chest injury is one that does not in itself demand surgery, or if the abdominal injuries include structures below the hypochondrium, a paramedian incision should be used. The diaphragm can be repaired from below with surprising ease. A combined thoraco-abdominal approach is very severe, and is hardly ever necessary.

The kidney may be wounded alone, or as part of an abdominal injury that involves many structures. Compared with the other solid organs, the liver spleen and pancreas, it stands up to the impact of projectiles remarkably well. It has very little tendency to fragment, it does not bleed profusely or long unless the main vessels are injured, it has considerable resistance to infection, and remarkable powers of recovery from partial injury. Thus nephrectomy is rarely indicated. In injuries to the kidney alone, the leading symptoms are hæmaturia, which is always present unless the ureter is divided or the kidney lacerated extensively, and the presence of a retro-peritoneal swelling in the loin which if large may lead to meteorism. An injured kidney should be approached through the loin, but in most cases interference should be limited to draining the perinephric space with a cylinder of vaseline gauze. A tangential injury at one pole may be trimmed and approximated with a few stitches. Nephrectomy is required for division of the ureter, injury to the main vessels, or profuse hæmorrhage from the torn kidney, laceration incompatible with recovery of function, and later for

persistent or recurrent hæmorrhage. A kidney injured in a trans-abdominal wound will be approached through the laparotomy incision and removed, if need be, by that route. In most cases it can be treated conservatively, but the retroperitoneal tissues must be drained.

Wounds of the pelvis are particularly fatal, not only because they tend to involve the bladder and the rectum but because the projectile usually enters through the thigh or the buttock. Injuries to the hip-joint and femoral vessels are commonly associated, and gas gangrene is a constant danger where large muscle masses are exposed to fæcal contamination. Both bladder and rectum may be wounded intraperitoneally, extraperitoneally, or in both portions. The openings in each must be discovered, trimmed and sutured, and the operation requires the Trendelenburg position, a good light, thorough anatomical knowledge and dogged persistence. The bladder wall must be freed well round the wound before the sutures are inserted, a step that is much more difficult in an empty organ than a distended one. When the injury involves the neighbourhood of the ureteric orifice, the ureter must be detached and implanted elsewhere in the bladder. The rectum can be reached from above in its upper four inches, but for injuries of the lower two it should be approached by an incision in the median raphé behind; to gain room it is better to extend this incision beside the coccyx than to remove the coccyx. After suture both the rectum and bladder should be drained, the rectum by colostomy, the bladder by a suprapubic tube. An indwelling catheter can give first class drainage when it is well looked after, but it is not fool-proof.

The above notes give a brief outline of the principles, rather than the practice, of the surgery of war wounds of the abdomen. There is something dramatic about the subject that has always brought it into the limelight. It is a pity that human suffering should ever be dramatized and that life-saving should ever become the battle ground of rival statistics. This is important surgery, and surgeons should seek no more than to be given the chance to do it under the best conditions, and to do it as well as they can. The surgeon with the lowest death-rate may get the credit, but the one with the lowest rejection rate is probably of most use to the Army.

A PORTABLE SHOWER AND DISINFESTOR UNIT.

BY CAPTAIN R. H. C. MANIFOLD,

Royal Army Medical Corps.

Purpose.—(a) Main : (1) hot showers : (2) disinfestor (Serbian barrel principle). (b) Subsidiary : (1) hot water for ablutions ; (2) hot water for cookhouse purposes.

Advantages.—This unit has been designed to meet the requirements of the smaller type of unit where only a cold water supply is laid on ; it can also be used where no water supply is laid on but streams or wells exist by means of buckets, stirrup-pumps, etc.

(a) *Very portable and compact.*—The whole unit, except for the wooden support, which folds up, packs into the one barrel.

(b) *Cheap to make and run.*—The total cost of the machine as built was 30s. This included everything, except the tar drum and the oil drum, which were obtained from salvage.

(c) *Extremely easy to work.*—The unit when built can be run up in twenty minutes and converted into the Serbian barrel in ten minutes.

Component Parts.

- (1) One 40-gallon tar drum.
- (2) 8 to 10-gallon oil drum.
- (3) Piece of metal piping ($\frac{1}{8}$ to $\frac{1}{4}$ inch) 21 by $5\frac{1}{2}$ inches.
- (4) Water piping and joints $\frac{3}{4}$ inch. roughly 30 feet.
- (5) 3 feet rubber hose, 1 inch diameter.
- (6) Sheet iron plate, for lid of main drum, 1 foot 11 inches diameter.
- (7) Four watering-can roses with rubber connexions.
- (8) Asbestos rubber for water and steam-tight joints.
- (9) Roughly 50 feet of wood 3 by 2 inches for the supports.
- (10) One tap, the handle of which is used as spanner for tightening the bolts of the supports.
- (11) A length of hose-piping for leading cold water supply.
- (12) Pot of red lead for insuring watertight joints.
- (13) Bolts and screws.

Showers.—There are four showers at 2 feet intervals, the first being 4 feet from the tank. The handle at the beginning controls the supply of water. The far end of the shower pipe is supported by a bracket of wood 3 inches by 2 inches, making showers 6 feet 6 inches from the ground.

When the shower is erected it takes roughly fifty minutes for the main tank to be full of hot water. The Hydra Burner should be lit and put under

PORTABLE SHOWER & DISINFESTOR UNIT

Diagram illustrating the components and dimensions of a Portable Shower & Disinfestor Unit.

Components and Dimensions:

- POLES:** 7'-7" LONG TRANSVERSES 2'-10"
- MAIN TANK:** 40 GALLON, 3'-10" diameter, 4'-1" height.
- COLD WATER TANK:** 10 GALLON, 1'-5" diameter, 1'-5" height.
- SAFETY VALVE PIPE:** 1'-5" length.
- STEAM TIGHT JOINT:** Located on the main tank.
- STOPPER IN SAFETY VALVE:** Located on the main tank.
- RUBBER CONNECTION:** Connects the main tank to the boiler.
- BOILER:** 350000 BPS, 1'-5" diameter, 1'-5" height.
- SAFETY VALVE PIPE:** 1'-5" length.
- STOPPER:** Located on the boiler.
- STEAM OUTLET:** Located on the boiler.
- INNER SIDE OF LID SHEWING JOINT:** Located on the boiler.
- HYDRA PUMP:** Connected to the boiler.
- BOILER SUPPORT:** Located below the boiler.
- METAL CLIPS:** Located on the boiler.
- ASBESTOS RUBBER JOINT:** Located on the boiler.
- SCREW HOLES:** Located on the boiler.
- COLD WATER PIPE:** Located on the boiler.
- RUBBER CONNECTION:** Connects the boiler to the pump.
- PUMP:** Connected to the boiler.
- WHEEL:** Located on the main tank.
- WEIGHT:** Located on the main tank.
- END PLATE:** Located on the main tank.
- BOILER:** 350000 BPS, 1'-5" diameter, 1'-5" height.
- SAFETY VALVE PIPE:** 1'-5" length.
- STOPPER:** Located on the boiler.
- STEAM OUTLET:** Located on the boiler.
- INNER SIDE OF LID SHEWING JOINT:** Located on the boiler.
- HYDRA PUMP:** Connected to the boiler.
- BOILER SUPPORT:** Located below the boiler.
- METAL CLIPS:** Located on the boiler.
- ASBESTOS RUBBER JOINT:** Located on the boiler.
- SCREW HOLES:** Located on the boiler.
- COLD WATER PIPE:** Located on the boiler.
- RUBBER CONNECTION:** Connects the boiler to the pump.
- PUMP:** Connected to the boiler.

the boiler and the cold water turned on—this insures a much more rapid filling of the tank with hot water than filling it with cold water before lighting the Hydra Burner. There is no danger of the tank exploding because the safety valve is under no pressure and communicates directly with the main tank. As the pipe is higher than the cold water tank it does not interfere with the hot water supply.

On testing the shower the following results were obtained : (a) 50 men could have five minutes' continuous hot water each in an hour ; (b) 100 men could be bathed in an hour if eight men at a time were using the showers. Four men washing and cleansing and 4 men under the showers alternatively.

The cold water supply is kept continuously turned on to give the necessary pressure. The amount of cold water necessary to keep the showers at a hot, even temperature, is easily adjusted.

To Convert Unit to Serbian Barrel Disinfector.

Disconnect the shower unit ; place the barrel on bricks ; take the safety valve pipe and screw it into the hot water end of the boiler ; leave the cold water pipe attached to the boiler, for the dual purpose of (a) acting as a safety valve to show when the boiler is nearly empty (when this occurs the steam, no longer under pressure from the remaining water, escapes) and (b) for refilling the boiler when empty.

Two pipe stoppers are used, one into the hot water pipe inlet and the other into the hole made by removing the safety valve pipe. Join safety valve pipe to hot water exit pipe by a metal jointing. Leave the shower control tap in sight. Leave main tank cold water connexion open to act as steam exit.

The barrel is now ready for use.

The top of the barrel is unscrewed and the clothes, etc., are put in, lid replaced and screwed down and the Hydra Burner lit.

On testing.—The time taken to disinfest 16 blankets was twenty-five minutes from the time of lighting the Hydra Burner.

For Cookhouses and Ablutions.

All that is needed is the boiler. The cold water feed pipe is left on, also the hot water pipe which is attached to the boiler. Hot water is produced in five to ten minutes. If a slow steady stream of cold water is added a constant flow of hot water is available. As soon as cold water is added to the boiler hot water comes out.

For heating purposes, where the Hydra Burner is not available, oil and water or an open fire will give the same results but they will be slower. In these cases the end plate of the boiler stand is removed, leaving the two side plates to act as a trench fire.

When packing.—The top of the main tank is unscrewed and into it is put the cold water tank which holds the boiler. The showers are taken down and the pipes unscrewed at the joints. These together with the remaining

dismantled parts are also placed in the main tank and the lid is then replaced. Therefore, when it is necessary to move, all that there is to be carried is one barrel and the collapsible wooden supports.

If the supports were also made of lengths of jointed piping they could be unscrewed and packed in the main tank as well, thus making the unit portable in one barrel. This was not done in this case as it would have added to the expense and the idea was to keep the cost of the unit as low as possible.



Editorial.

YELLOW FEVER IN THE SUDAN.

THE following facts are gleaned from an article entitled "An Epidemic of Yellow Fever in the Nuba Mountains, Anglo-Egyptian Sudan," by Dr. R. Kirk, appearing in the *Annals of Tropical Medicine and Parasitology*, October 21, 1941, 35, No. 1.

In 1934 it was definitely proved that the Nuba country of the Sudan was infected, or, at least, that 23 per cent of the sera collected there were able to protect mice against the yellow fever virus.

"In 1935 the histopathology of a liver section obtained by viscerotomy from a patient who died in Malakal after a febrile illness associated with jaundice was considered suggestive of yellow fever."

The patient had come from the Eliri district of the Nuba Mountains and, accordingly, sera from the area were sent to Dr. G. M. Findlay in London and a high proportion was found to be mouse protective from certain places though, we gather, not from all.

It appeared, therefore, that either yellow fever or some other illness capable of producing an immunity against yellow fever was or had recently been fairly wide-spread in that portion of the Sudan.

Inquiries proved that the district of Gulfan had been visited by a disease having the characteristics of yellow fever in 1934. This disease had been marked out by the presence of jaundice and had killed some twenty to forty of the people. It had, moreover, "produced considerable alarm among the population," a point to be noted in this connexion. Dr. Kirk lays stress on this. He says: "The present writer has observed two severe epidemics of cerebrospinal meningitis in the Nuba Mountains, in which the mortality rate was about 70 per cent, and in both instances the number of deaths was considerably higher than in this yellow fever epidemic; yet the amount of alarm caused by the cerebrospinal meningitis was negligible compared with that produced by the yellow fever epidemic."

In 1940, Dr. Ahmed Effendi el Araki, who had been at Gulfan in 1934, and was now stationed at Kauda, was impressed with the close resemblance of an outbreak of disease in the Tira and Otoro hills to the cases which he had seen in Gulfan in 1934 and he called the attention of the District Commissioner from Talodi, who was visiting the area, to this fact. The District Commissioner, on his return to Talodi, sent information on to Khartoum by telegraph and then fell sick with the disease himself!

The result was that Dr. Kirk, two British colleagues and a Sudanese laboratory assistant were sent to the scene of the epidemic forthwith.

The epidemic proved to be a very serious one leading, as far as could be ascertained, to 15,267 cases at least and to a total of 1,577 deaths. Immunity surveys carried out before and after the outbreak make it evident that about twice as many were infected as the number of recorded cases, though in most of the latter the disease was mild and clinically more like influenza than yellow fever. Arabs, Nubas and Europeans were about equally infected, race appearing to have but little effect on the mortality.

The nature of the epidemic was recognized by the following tests :

Pathological, by the finding of characteristic appearances in the livers of persons dying of the disease.

Immunological, by the demonstration that those suffering from the disease gave double mouse-protection tests.

Experimental, by the isolation of typical yellow fever virus from the blood of patients early in the disease.

Epidemiological, by the proof that the epidemic was followed by a rise in the proportion of immunes by mouse-protection tests.

The symptomatology is reviewed under certain headings ; headache, congested eyes, the appearance of the tongue, temperature and pulse (and a number of excellent charts of these are given), jaundice, nausea, vomiting and retching, the characters of the urine, hæmorrhages, hæmatemesis and melæna, the blood and the manner of dying.

The picture given of yellow fever is quite accurate and the disease is therefore demonstrated to produce epidemics in the Nuba Mountains and perhaps in other parts of the Sudan. A danger, in fact, must be regarded as existing until such time as it may be possible to inoculate the people against it. We fail to derive from this account, however, the same feeling of awe and fear as was once given by accounts of " Yellow Jack " in the West Indian Islands and other places exposed. Perhaps it was to our clouded imaginations that these accounts appealed, a similar " fear " to that described by Kirk as so common even in the Sudan ; or perhaps minor attacks were then unrecognized and therefore not appreciated as manifestations of the disease. At any rate the terror goes out of our mental picture when we find only a 10 per cent mortality instead of a death-rate in keeping with what we thought an almost invariably fatal disease. It is a pleasure to read this excellent account and to find that the disease is no longer what it was once thought to be.

Echoes from the Past.

REPRODUCTION OF AN ANCIENT COMMISSION.

DEAR SIR,—I think that perhaps the enclosed may be of some interest to your readers.

I am far from books of reference and must confess to an ignorance of what our Army was doing in Germany in 1760, and as to who are the signatories to the document. Can the "Granby" whose name appears among them be the celebrated Marquis whose name conjures up visions of foaming tankards under the trees of quiet country inns? Perhaps some of your readers can throw some light.

It will be noted that in those days the "Other Rank" was a "private person" and that the "Surgeon's Mate" was particularly warned against the reprehensible practice of selling his drugs and equipment for private gain!

I am greatly indebted to Lt.-Col. Rainsford, Provost Marshal of this Force, for presenting the document which I hope will find its way to our museum in due course, and to the East African Survey Company for their kindness in making the reproduction.

*Office of the Director
of Medical Services,
East Africa Force.
August 1, 1941.*

Yours faithfully,
R. E. BARNESLEY,
Colonel.

[The historical document reproduced on p. 317 is evidently an old Commission granted to Henry Remington as Surgeon's Mate to the Train of Artillery in Germany and bears date 1760. At that time the English were closely involved in the operations of H.M. King Frederic of Prussia—Frederic the Great—and were sending British units to assist him. Henry Remington, no doubt, was attached as Surgeon's Mate to the Train of Artillery sent to Germany with the latter. The Marquis of Granby was the "Second in Command" of the British troops in Germany at that time and probably signed the Commission in this capacity.—EDITOR.]

of the said Train, the Surgeon, and all other
your Superior Officers according to the Rules
and Discipline of War?

Given at the Office of His Majesty's Ordnance
under Our Hands and the Seal of the said Office
this Twenty fifth — day of March — 1740
and in the thirty third Year of his Majesty's reign

By *Charles Frederick Mordaunt*
AM

That looks

Instructions for
Henry Cunningham Surgeon
Hence to the Train of Artillery
in Germany

You are to attend the following points:
Professors and others as well as the Officers belonging to
the Train shall have an Exercise when called upon to
Administer proper Medicines and perform all necessary
Operations for their relief according to the best of your
Skill and Judgment; and according to the Orders and
Directions you shall receive from the Surgeon to the said
Train.

You are not to deliver Dispensaries of the said
Medicines provided for the use of the said Train, nor
to consent them to receive the same any further or what time
nor offer it to be taken so far as it may be in your power
to prevent the same, otherwise you will not be
Excused for such Offence.

You are to follow all such Orders and
Directions as you shall receive from the Master General,
Lieutenant General and principal Officers of the
Ordnance for the time being, the Commanding Officers
of

Clinical and other Notes.

ACUTE MENINGOCOCCAL CONJUNCTIVITIS.

BY MAJOR F. CLIFTON,
Royal Army Medical Corps,

AND

MAJOR S. M. LAIRD,
Royal Army Medical Corps.

ACUTE purulent conjunctivitis and the demonstration of Gram-negative diplococci in the conjunctival smear naturally arouses the suspicion of gonococcal infection. This article seeks to focus attention on the less widely appreciated point that another member of the Neisserian group of organisms may closely simulate acute gonococcal conjunctivitis. The importance of establishing a correct bacteriological diagnosis in such cases is obvious at any time but is particularly necessary under present conditions, where the number of meningococcal carriers amongst large concentrations of troops may be relatively high. Much inconvenience and hardship may otherwise be unjustly inflicted upon innocent persons.

The introduction of serum therapy greatly reduced the incidence of acute conjunctivitis which previously complicated the terminal stages of cerebrospinal meningitis. Thus Randolph in 1893 quoted Hirsch and Ziemssen and Hess as finding it as an invariable concomitant, and McKee (1908 and 1909) isolated and positively identified meningococci from the conjunctivæ of three patients suffering from cerebrospinal meningitis. With serum therapy, however, no conjunctivitis occurred in a series of 66 cases reported by Lewis and in only one of a large number of cases reported by Tillett and Brown in 1935. Cushing reported that conjunctivitis was present in four out of 124 cases of cerebrospinal fever prior to commencing chemotherapy. Reese has recorded the case of a student nurse who, following contact with cerebrospinal fever, developed an acute unilateral conjunctivitis and mild signs of meningitis which responded satisfactorily to serum therapy. Cultures from the conjunctiva, nose, throat, blood and cerebrospinal fluid grew Type I meningococci and, although meningococci were found in the cerebrospinal fluid, no classical signs of meningitis developed.

The occurrence of acute meningococcal conjunctivitis without other clinical evidence of meningococcal infection is, however, of greater importance than the occurrence of conjunctivitis complicating meningitis as described above. Several examples of the former are on record; Koplik, in a report on 77 cases of cerebrospinal fever, described one case in which there was a definite history of conjunctivitis prior to the appearance of meningeal manifestations, and Smith reported a case of meningococcal

conjunctivitis occurring in a nurse who had been exposed to epidemic cerebrospinal fever. In this latter case, the organism was clearly identified by cultural study and the conjunctivitis responded to local treatment in a few days, without the development of meningitis. More recently, Hayden *et al.*, and Bennett have both recorded single cases of meningococcal conjunctivitis. In the former instance, one of the authors was infected by buccal spray whilst examining a hospital patient from whose sputum and post-nasal secretion the infecting organism was subsequently isolated and shown to belong to Type II. The conjunctivitis responded within a few days with purely local treatment. In the case described by Bennett, Type I meningococci were isolated from the conjunctiva alone and the eye condition was cured within seventy-two hours by local measures and chemotherapy with sulphapyridine. In both these patients it was noted that neither the degree nor the clinical course of the unilateral conjunctivitis was so severe as is commonly met with in cases of gonococcal conjunctivitis which was the provisional diagnosis made before complete bacteriological investigation had revealed that the Neisserian organism present was a meningococcus.

CASE REPORTS.

We have treated two cases of acute meningococcal conjunctivitis which were referred to hospital within a period of nine months. In both cases a diagnosis of gonococcal conjunctivitis had been made before admission, but the absence of any evidence of infection in the genito-urinary tract led us to suspect that we were dealing with meningococcal conjunctivitis. The first case unfortunately received sulphapyridine before cultural studies were made but, in the second case, full bacteriological investigation confirmed the diagnosis. Neither case, at any time, showed clinical evidence of involvement of the central nervous system.

Case 1.—The patient, aged 23, was admitted to hospital in the late evening of February 28, 1940, ten days after joining the Army. He had had bronchitis for five days and, on February 27, 1940, he noticed that his eyes were "blood-shot." On the morning of the day of admission he had photophobia, his eyes being painful, with swollen lids and a considerable amount of discharge. Exposure to venereal disease was convincingly denied. On examination the following morning, bilateral purulent conjunctivitis without severe chemosis or corneal ulceration was present. There was some catarrhal bronchitis and injection of the pharynx with mild pyrexia. Thorough investigation of the genito-urinary tract, including an examination of the prostatic fluid, revealed no abnormality. The conjunctival smear, taken on admission, contained numerous pus cells and Gram-negative diplococci. Local treatment and sulphapyridine had been instituted without delay on the night of admission and it was, therefore, not unexpected when conjunctival and post-nasal cultures, taken the following day, failed to grow any Neisserian organism. The patient was completely cured by March 6, 1940, the eyes being normal and the respiratory condition having completely abated.

Case 2.—The patient, aged 21, was admitted to hospital on December 7, 1940, with a history of discharge from the left eye for two days previously and coryza. The right eye was normal. There was a fairly profuse muco-purulent discharge from the left eye and slight oedema of the lids. The whole of the cornea showed

punctate staining points with three marginal ulcers between 11 and 1 o'clock. The smears showed a large number of pus cells and Gram-negative diplococci, the majority of which were extra-cellular. They resembled gonococci except in the absence of the characteristic concavity of the adjacent sides of pairs. Cultures and agglutination positively identified the organism as a Group I meningococcus. Treatment with M & B 693 was instituted the same day and a post-nasal swab, taken twenty hours after commencement of treatment, showed a practically pure growth of chromogenic *Neisseria*. Eight days after admission the cornea had healed and the conjunctivitis had practically resolved. Six days later, a horizontal line of minute staining points appeared on the cornea but, by December 26, 1940, there was complete clinical recovery. A post-nasal swab, from which no meningococci could be grown, was taken prior to discharge.

SUMMARY.

Two cases of acute purulent conjunctivitis caused by meningococci are described, in which other clinical evidence of meningococcal infection was absent. The condition may easily be confused with gonococcal ophthalmia unless this possibility is kept in mind and a full bacteriological study is carried out. In general, it would appear that the severity and clinical course of meningococcal conjunctivitis is less severe than that of gonococcal ophthalmia and that a rapid cure is achieved by orthodox local treatment with or without chemotherapy.

We are indebted to the Commanding Officer of a military hospital for permission to use the clinical notes of these cases.

REFERENCES.

- BENNETT, J. A. (1940). *JOURNAL OF THE ROYAL ARMY MEDICAL CORPS*, **75**, 4, 264.
 CUSHING, R. W. (1940). *Brit. Med. Journ.*, **2**, 439.
 HAYDEN, A. F., and HAYDEN, A. F. (1939). *Brit. Journ. Ven. Dis.*, **15**, 45.
 KOPLIK, H. (1904). *Med. News*, **84**, 1065.
 LEWIS, P. M. (1931). *Southern Med. Journ.*, **24**, No. 2, 101.
 MCKEE, H. (1908). *Ophth. Rec.*, **17**, 438.
Idem. (1909). *Ophth. Rec.*, **18**, 304.
 RANDOLPH, R. L. (1893). *Bull. Johns Hopkins Hosp.*, **14**, No. 32, 59.
 REESE, F. M. (1936). *Amer. Journ. Ophth.*, **19**, 780.
 SMITH, D. (1905). *Arch. of Ophth.*, **34**, 481.
 TILLET, W. S., and BROWN, T. MCP. (1935). *Bull. Johns Hopkins Hosp.*, **57**, No. 5, 297-316.

NOTES ON CASES OF CHRONIC DIARRHŒA AND VAGUE ILL-HEALTH, APPARENTLY DUE TO THE FLAGELLATE *GIARDIA LAMBLIA*.

BY MAJOR J. E. JAMESON,
Royal Army Medical Corps.

THE significance of *Giardia lamblia* in the stools has long been controversial. An account is given in these notes of the results in lambliais of atabrin therapy which, due to its apparent "specificity" for *Giardia*, provides a new means of investigating the pathogenicity of this flagellate.

This line of investigation of cases of diarrhoea and ill-health in which *Giardia lamblia* is also present in the stools was suggested to the writer by the good results claimed in the treatment of *Giardia cholecystitis* with atebirin.

During the past month, 8 cases discovered to be passing this flagellate in the stools were given by mouth atebirin (or quinacrine) 0.1 gram t.d.s.p.c for seven days, after which a further examination of the stools was carried out. In every case the flagellate could not be demonstrated after treatment as will be seen from the Table which follows.

TABLE OF STOOL EXAMINATIONS.
Report on Stool before treatment. Report on Stool after treatment.

No.	Date	Type of stool	Exudate	Microscopy	Culture	Date	Type of stool	Exudate	Microscopy
1	16.4.41	S.M.	OX	G.L.C.	N.D.	29.4.41	N.	OX	N.A.F.
2	14.4.41	L.M.	AX	E.H.V.	N.P.I.	—	—	—	—
	4.5.41	L.M.	IX	G.L.V.	N.P.I.	17.5.41	N.	OX	N.A.F.
3	5.5.41	L.B.M.	AX	E.H.V.	N.P.I.	23.5.41	N.	OX	N.A.F.
				G.L.V.					
4	30.4.41	L.	OX	G.L.C.	N.P.I.	22.5.41	N.	OX	N.A.F.
5	7.5.41	S.	OX	G.L.C.					
				C.M.V.	N.D.	19.5.41	N.	OX	C.M.V.
				B.H.					
6	9.5.41	S.	OX	G.L.C.	N.D.	16.5.41	N.	OX	N.A.F.
7	9.5.41	S.	OX	G.L.C.	N.D.	18.5.41	N.	OX	N.A.F.
8	7.5.41	L.	OX	G.L.C.	N.P.I.	22.5.41	L.*	OX	N.A.F.

INDEX OF ABBREVIATIONS USED IN TABLE.

S.	Semi-solid stool	IX	Indefinite exudate	C.M.V.	<i>Chilomastix mesnili</i> vegetative forms present
L.	Loose stool	OX	Nil exudate	B.H.	Blastocystis hominis
N.	Normal stool	*	After aperient	N.D.	Not done
B.	Blood present	G.L.V.	<i>Giardia lamblia</i> vegetative forms present	N.P.I.	Nil pathological isolated
M.	Mucus present			N.A.F.	Nil abnormal found
AX	Amœbic exudate	G.L.C.	<i>Giardia lamblia</i> cysts present		
		E.H.V.	<i>Entamoeba histolytica</i>		

The above tabulation shows the laboratory aspect of these cases, which will now be considered from the point of view of the physician.

Case 1.—Serjeant X. During the year previous to admission he had been suffering from attacks of diarrhoea with a periodicity of about six weeks. He was admitted on March 10, 1941 to “?” General Hospital where the diagnosis of “dysentery, indefinite exudate” was made.

The patient did not respond to treatment in the usual way and rectal lavage was resorted to, but without success, mucus still being passed freely in the stools. On April 5, for military reasons, he was transferred to No. — British General Hospital where, though he had no diarrhoea, his daily stool contained much mucus and sometimes consisted entirely of it. The idea of invaliding him home as a “chronic mucus carrier” had for some time been considered, and a further laboratory test was then asked for. This showed the presence of cysts of *Giardia lamblia* (see Table). The patient responded quickly to atebirin and returned to normal duty before completion of the seven days’ course. He was discharged to duty, Category A.1 on May 3.

Case 2.—Corporal Y. For nine weeks before admission he had suffered from diarrhoea but had carried on. About April 7, 1941, he noticed blood and mucus

in his stools, reported sick and was admitted to — British General Hospital on April 14, where traces of blood and mucus were also seen in his stools.

On April 16, *Entamoeba histolytica* was found in the stools and the patient was accordingly given a course of 1 grain of emetine daily for twelve days. On completion of this course he was still passing five or six loose stools daily and a second stool examination on May 4 revealed the presence of numerous vegetative forms of *Giardia lamblia*.

A course of atebirin was started on May 7, and the stool chart was as follows :

7.5.41	..	3 loose stools
8.5.41	..	3 loose stools
9.5.41	..	3 loose stools
10.5.41	..	2 formed stools
11.5.41	..	2 formed stools
12.5.41	}	.. 1 formed stool
13.5.41		
14.5.41		
15.5.41		
16.5.41		

The patient was discharged to duty, Category A.1 on May 19.

Case 8.—Private Z. This patient had his first attack of diarrhoea five days after calling at Freetown on his way to the Middle East. The attack, which lasted a week, was accompanied by abdominal pains and about twelve stools were passed daily without evidence of blood or mucus. At intervals of three, three, four and six weeks he suffered similar attacks. The last of these had persisted for three weeks when a stool was sent for laboratory investigation (*see Table*).

The patient was given similar treatment to the others, and his diarrhoea ceased after three days. Two days later he had to be given salts to procure a stool for a second examination, a state of affairs which elicited the comment, "This is not at all like me."

This patient, who was unusually intelligent in giving his history, was most emphatic in his praise of the treatment and considered himself fully restored to health.

The five remaining cases, in which the benefit is not so clearly due to atebirin, are summarized as follows :

Case 3.—The patient had a mixed infection with *E. histolytica* and *Giardia lamblia*. He made an uneventful recovery on emetine followed by quinacrine. Owing to a misunderstanding no stool was sent for examination between the two courses.

Case 4.—A food handler, found to be passing cysts of *Giardia* in a routine stool examination, admitted on being questioned that he had recently had diarrhoea. He was treated and claimed benefit but was a bad witness.

Cases 5 and 6.—These were received for gastric investigation. Each case would have been discharged fit about twelve days after commencement of atebirin treatment but for the presence in one case of a gunshot wound in the arm and in the other of faulty teeth.

Case 7 was received as "N.Y.D. Malnutrition." He gave a history of diarrhoea before admission and his general poor state of health led to the suspicion of phthisis. He shows obvious signs of having "turned the corner" since treatment with atebirin.

The results to date of this investigation tend to incriminate *Giardia* as a cause of vague gastric disorders or of frank diarrhoea with periodic remissions. These latter cases do not produce blood and mucus or dysenteric exudation

in the stools unless the infection is superadded on a dysentery, an association which appears to occur frequently.

An interesting finding in Case 5 (see Table) was that a second flagellate present, thought to be *Chilomastix mesnili*, was unaffected by the treatment and its continued presence did not appear to inconvenience the patient.

Though it may justly be argued that the cases reported are too few for conclusive evidence it has been thought desirable to submit the results so far achieved in the hope that this treatment may be equally successful in other hospitals.

My thanks are due to Lieutenant-Colonel A. Harrison-Hall, R.A.M.C., Commanding — British General Hospital, for permission to submit this report, to Major C. M. Vaillant, R.A.M.C., Medical Specialist, for his advice and goodwill and to Captain E. J. P. McDowell, Captain N. H. H. Longton and Captain R. H. Hogg, R.A.M.C., for their willing co-operation in treating these patients, in the sending of specimens for laboratory investigation and for their notes on the cases.

A NOTE ON AIR-BORNE INFECTION IN HOSPITALS.

By MAJOR N. H. MARTIN, B.M., M.A., M.R.C.P., F.I.C.

Royal Army Medical Corps.

THE apparatus described was devised and made in this laboratory to investigate air-borne infection in the passages and wards of the hospital. Shortly after we opened in 1940 the Officer Commanding Surgical Division

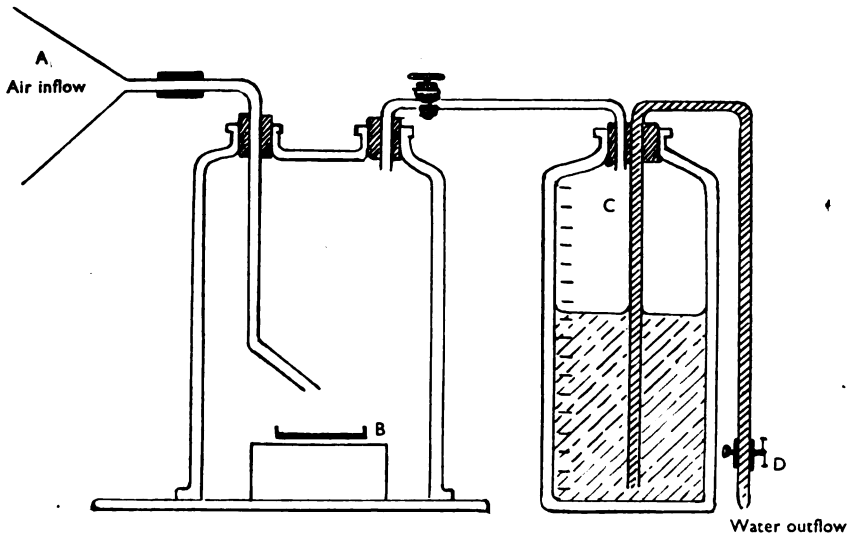


FIG. 1.—Diagram of the apparatus used for sampling.

asked for an investigation of the causes of post-operative chest and nasopharyngeal infection.

At the time there was a considerable amount of dust circulating from active structural alterations still in progress.

The apparatus (fig. 1) consists of a 6 inch funnel "A" connected with a Bulloch's Apparatus. The inflow tube is led over a Petri dish "B" as shown. The air replaced from the jar is drawn off into reservoir "C" the rate of flow being controlled by the jet on the syphon at "D." The volume of the sample is measured by the calibration of the reservoir "C."

The Petri dish is incubated in the Bulloch's jar in contact with the sample of air or it may be removed and incubated in the normal manner.

This simple apparatus can be assembled from the standard laboratory equipment on the I.1248. The volume of contaminated air to which the plate is exposed is measured as is the time of exposure. The rate of sampling

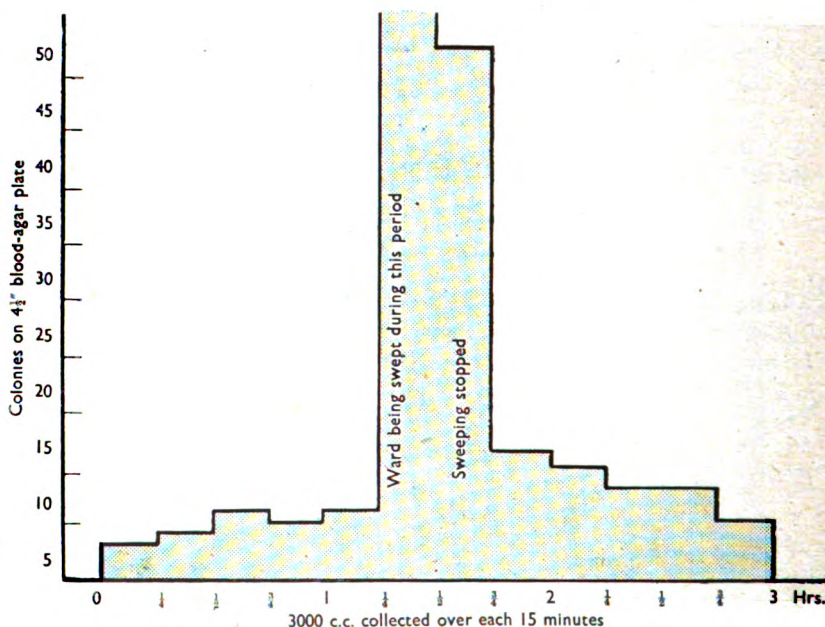


FIG. 2.—Composite graph showing the effect of sweeping.

can be varied by altering the jet "D." Samples can be taken in the form of "sweeps" along passages.

The accuracy of the results we obtained cannot be compared with the more elaborate investigations which Professor Miles and his team were carrying on at the same time. Nevertheless our findings did agree broadly with theirs. We were able to demonstrate the following points of practical importance.

(1) Certain routes from the surgical wards to the theatre gave consistently higher bacterial counts for standardized samples of air than others. These routes could be avoided.

(2) Counts were higher at certain times of the day than others. These times could be avoided for wheeling patients to the theatre.

(3) The bacterial content of the air in the wards rose steeply after sweeping. Diagram 2 shows a graph illustrating this. It illustrates the fact that the count did not return to normal until one hour after sweeping.

The counts we made were total counts, moreover it is obvious that each colony cannot be regarded as springing from one organism. The absolute figures are therefore of less value than the comparative figures. In spite of the many objections which we realize can be levelled at this piece of home-made apparatus it did give results of practical value.

Thanks are due to Colonel R. A. Anderson, M.B., F.R.F.P.S., for permission to forward this article for publication in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS.

REFERENCE

MILES, A. A. *et al.* (1940), *Brit. Med. Journ.*, December, p. 895.

Current Literature.

FRANCIS, T., Jr., and MOORE, ALICE E. **A Study of the Neurotropic Tendency in Strains of the Virus of Epidemic Influenza.** *J. Exper. Med.* 1940, Dec. 1, v. 72, No. 6, 717-28.

Stuart Harris [*Bull. of Hyg.*, 1939, v. 14, 575], showed that the W.S. strain of influenza virus could be made to produce an encephalitis in mice if it were subjected to serial passages through hens' eggs followed by serial passages through the brains of young mice.

In the present paper the authors confirm the ability of the W.S. strain to produce an encephalo-meningitis in mice when injected intracerebrally, but they found initial passages through eggs unnecessary: the virus "cultivated in the usual chick embryo culture medium" would produce the central nervous disease when injected intracerebrally without previous treatment. No evidence was obtained of the adaptation of the virus to a more highly neurotropic state. The comparative virulence of the strain administered intranasally or intracerebrally remained practically constant. The neurotropic effect of the virus seemed to be governed solely by the route of inoculation.

The Melbourne strain of influenza virus was also found to be neurotropic in the mouse; but five other strains (Henry, Talmey, Swine 1976, Alaska and Swine 15) were not.

The neurotropic characteristic seems to be inherent in the two strains rather than a new property acquired by adaptation.

Cross protection tests with the strain P.R.8, which is not neurotropic, indicated that the pneumotropic and neurotropic strains of W.S. were antigenically similar.

E. T. C. SPOONER.

Reprinted from "Bulletin of Hygiene," Vol. 16, No. 5.

Reviews.

WARWICK AND TUNSTALL'S FIRST-AID TO THE INJURED AND SICK. 18th Edition. Edited by Norman Hammer, M.R.C.S., Major, late R.A.M.C., T.A. Bristol: John Wright & Sons, Ltd. 1941. Pp. 320. Price 3s. 6d.

That a "First Aid" should have reached its 18th edition and 215th thousand needs no word of praise to indicate its popularity and usefulness.

It is stated in the Preface that many new illustrations have been introduced and certain old ones deleted. Part II dealing primarily with First Aid has been practically rewritten.

The expressed hope of the Editor of the book that the edition will be of interest and assistance to our splendid Civil Defence workers is, we feel sure, certain of fulfilment.

INDEX-CATALOGUE OF MEDICAL AND VETERINARY ZOOLOGY. Part 4. Authors: D. to Džunkovski. Issued in June, 1940. United States Department of Agriculture.

We have received a copy of Part 4 of this important Index-catalogue, which has been placed in the Library of the Royal Army Medical College.

The Index is on sale by the Superintendent of Documents, Washington, D.C. Price 30 cents.

A POCKET MEDICAL DICTIONARY. Fifth Edition. By Lois Oakes, S.R.N., D.N. (London and Leeds). Edinburgh: E. & S. Livingstone. 1941. Pp. xx + 418. Price 3s. 6d.

The issue of a fifth edition of this little dictionary so soon after the last edition is a proof of its popularity. Intended primarily for junior medical students it fulfils its function admirably. In addition to the comprehensive dictionary of medical terms, useful appendices on first-aid, gas warfare, urine testing and diets are given. We recommend this little book.

HOW THE BODY WORKS. Alternative edition with extra chapter. By L. S. Michaelis, M.D. Drawings by Kupfer-Sachs. London: Longmans, Green & Co., Ltd. First published 1940. Pp. xvi + 64, Figures 71. Price 2s.

This is a short easily read book which seeks to deal with Physiology in terms of everyday analogies. While bridges, ships, pumps and wireless are invoked to illustrate the functions of various organs the comparisons are not overdrawn and a reasonable sense of proportion is maintained throughout the book. The marginal drawings are good, illustrate the text

and do much to keep the readers' interest. Technical terms that so commonly damp the ardour of the recruit who is anxious to learn are remarkable for their absence and, at the same time, the reader is not left in any doubt as to what an organ does and has a simple idea of how it does it. In this the book succeeds where many lecturers fail—"It adds artistic versimilitude to an otherwise bald and unconvincing narrative." The book should prove helpful to many who lecture from the R.A.M.C. Training Manual and should find a place in the Unit educational library—it will appeal and be helpful to many of the present type of intake.

R. W.

SURGERY OF THE HEART. By E. S. G. King, M.D., M.S., D.Sc.Melb., F.R.C.S.Eng., F.R.A.C.S., Major, R.A.M.C. London: Edward Arnold and Co. 1941. Pp. 709. Price 50s. net.

Surgery of the Heart is based upon the successful Jacksonian Prize Essay of the Royal College of Surgeons for the year 1938. The work is an exhaustive treatise, covering some 700 pages, in which the author has interpreted his subject in the widest possible sense. The book is divided into two sections, the one dealing with details of anatomy, physiology, pathology, radiology and electrocardiography and the second with surgical approach, experimental investigations, diseases of the myocardium, coronary vessels, endo- and pericardium and the great vessels.

The bibliography is immense, every known view is propounded with a clear and exact style. The work is indeed a monument of industry of which the author may justifiably be proud and for which those of the medical profession interested in the subject should be grateful.

Yet admiration for industry such as this is touched a little by a sense of disappointment for the level exact style seems strangely out of keeping with a subject of such absorbing interest. The book might even have been shorter without diminishing its value and certainly without diminishing its interest, for with the best will in the world the reader is apt to let his mind wander from the written word: to read this book through is indeed a test of endurance.

The book does not contain any original work but is complete in the sense that the work of others is given in detail—though those of us who watched with such great interest the work of the late Lawrence O'Shaughnessy will be disappointed at the small space devoted to his animal and clinical research.

The format is good and the work adequately illustrated; the index is, however, not of the same standard of thoroughness as the rest of the book.

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C.N. = Clinical and other Notes.

C.L. = Current Literature.

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JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS

Corps News.

DECEMBER, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

Oct. 21.—Col. J. T. Simson, M.B. (1964), (late R.A.M.C.), having attained the age for retirement, retires on ret. pay, Oct. 21, 1941, and remains empld.

Lt.-Col. (temp. Col.) J. C. A. Dowse, M.C., M.B. (8626), from R.A.M.C., to be Col. Oct. 21, 1941, with seniority Apr. 15, 1939.

Maj. (temp. Lt.-Col.) A. J. Beveridge, O.B.E., M.C., M.B. (8619), to be Lt.-Col. Oct. 21, 1941.

Oct. 24.—Maj. (Or.-Mr.) W. C. Prince, O.B.E., M.M. (44229), having attained the age for retirement, is placed on ret. pay, Oct. 23, 1941.

Capt. (Or.-Mr.) G. P. Steer, M.B.E. (51928), to be Maj. (Or.-Mr.), Oct. 23, 1941.

Oct. 28.—The undermentioned Capt. (Short Service Officers), are appointed to perm. commns., retaining their present seniority:

Aug. 1, 1941:

(Temp. Maj.) J. F. Wilson, M.B., M.D. (62173).

Oct. 1, 1941:

A. B. Dempsey (66501).

Oct. 23, 1941:

R. S. Hunt (70112).

G. B. Heugh (70114).

(Temp. Maj.) W. Stewart, M.B.E., M.B. (70115).

(Temp. Maj.) E. A. Smyth, M.B. (70120).

(War Subs. Maj.) (Temp. Lt.-Col.) J. A. Davidson, M.B., M.D. (70121).

(Actg. Maj.) C. L. Lewis (58964).

Oct. 24, 1941:

W. N. L. Haynes (44417).

(Temp. Maj.) J. R. Kellett, M.B. (66477).

(Temp. Maj.) K. G. F. Mackenzie, M.B. (66482).

Oct. 27, 1941:

I. N. Fulton (70127).

Temporary Commission.—War Subs. Capt. F. R. How (16569), relinquishes his commn.

on account of ill-health Oct. 29, 1941, retaining the rank of Capt.

Oct. 31.—Maj.-Gen. F. Casement, D.S.O., M.B., K.H.S. (8370) (late R.A.M.C.), retires on ret. pay Oct. 29, 1941, and remains empld.

Col. (actg. Maj.-Gen.) G. Wilson, O.B.E., M.C., M.B. (26291) (late R.A.M.C.), to be Maj.-Gen. Oct. 29, 1941.

Col. A. G. Biggam, O.B.E., M.D., F.R.C.P., K.H.P. (14900) (late R.A.M.C.), to be Maj.-Gen. (supernumerary). Oct. 29, 1941.

Lt.-Col. (temp. Col.) H. B. F. Dixon, M.C., M.D., F.R.C.P. (10659), from R.A.M.C., to be Col. Oct. 29, 1941, with seniority Apr. 28, 1939.

Maj. (temp. Lt.-Col.) D. Fettes, O.B.E., M.B., F.R.C.S. (Edin.) (15746), to be Lt.-Col. Oct. 29, 1941.

Nov. 4.—The KING has been pleased to approve of the undermentioned appt.:

Lt.-Col. (temp. Col.) S. Smith, M.B., F.R.C.P. (14376), R.A.M.C., is apptd. Hon. Physician to The King, Oct. 13, 1941 (vice-Maj.-Gen. R. C. Priest, C.B., M.D., F.R.C.P. (14073), (late R.A.M.C.), who has retired).

Nov. 7.—Maj. A. C. H. Gray, O.B.E., M.B. (10101), (late R.A.M.C.), reverts to ret. pay and resumes the rank of Col. on ceasing to be re-empld. Nov. 8, 1941.

Nov. 11.—Col. K. Comyn, M.D. (4596), (late R.A.M.C.), retires on ret. pay, Nov. 9, 1941, and remains empld.

Lt.-Col. (actg. Brig.) W. C. Hartgill, O.B.E., M.C. (8648), from R.A.M.C., to be Col. Nov. 9, 1941, with seniority from July 1, 1937.

Maj. (temp. Lt.-Col.) T. Menzies, M.B. (8428), to be Lt.-Col. Nov. 9, 1941.

Short Service Commission.—Lt. J. P. Crawford (154902), to be Capt. Nov. 1, 1941.

Nov. 14.—The KING has been pleased to approve of the following appts.:

To be Hon. Surgeons to the King:

Maj.-Gen. G. Wilson C.B.E., M.C., M.B. (26271) (late R.A.M.C.), Oct. 13, 1941 (vice

JOURNAL OF THE ROYAL ARMY MEDICAL CORPS

Corps News.

JULY, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

May 23.—Col. W. L. E. Fretz, M.B., late R.A.M.C. (15682), having attained the age for retirement, retires on ret. pay. May 22, 1941.

Lt.-Col. (temp. Col.) J. G. Gill, *D.S.O.*, *O.B.E.*, *M.C.*, M.B. (8368), from R.A.M.C., to be Col., May 22, 1941, with seniority July 1, 1937.

Maj. (temp. Lt.-Col.) E. S. Cuthbert (15375), to be Lt.-Col. May 22, 1941.

Short Service Commission.—The appt. of Lt. D. W. Bentinck (75590), is ante-dated to Nov. 1, 1937, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allices. prior to May 1, 1938.

Lt. D. W. Bentinck (75590), to be Capt. May 1, 1939, with seniority Nov. 1, 1938, and precedence next below Capt. A. F. Murray, M.B. (Substituted for the notfn. in the *Gazette* of May 5, 1939.)

May 27.—*Short Service Commission.*—Capt. C. E. Watson (67839), is placed on the h.p. list on account of ill-health. Apr. 16, 1941.

Capt. C. E. Watson (67839), h.p. list, retires on account of ill-health. Apr. 23, 1941.

The KING has been graciously pleased to approve of the following appt. :—

May 30.—Col. C. A. Wood, *M.C.*, M.B., B.S. (Lond.), D.P.H. (Lond.), D.T.M. & H. (Lond.), (183717), Ind. Med. Serv., is appt. Hon. Physician to The King, Dec. 25, 1940 (vice Maj.-Gen. H. C. Buckley, M.D., F.R.C.S. (Edin.), Ind. Med. Serv., who has retired).

June 3.—Capt. (temp. Maj.) R. C. Langford (52028) to be Maj. May 15, 1941.

Short Service Commission.—Capt. C. W. A. Hughes (90374) to take rank and precedence in his Corps and in the Army, as if his appt. as Capt. bore date Mar. 31, 1941.

June 6. — Col. (temp. Brig.) W. H. O'Riordan, *M.C.* (5283) (late R.A.M.C.), retires, and remains empld. June 6, 1941.

The undermentioned, at their own request, revert to the rank stated whilst employed during the present emergency :—

As Majs. :—

Lt.-Col. A. C. Elliott, M.B. (8275), ret. pay, R.A.M.C. Apr. 3, 1940.

Lt.-Col. W. Davis, M.B. (9936), ret. pay, R.A.M.C. July 29, 1940.

Lt.-Col. A. T. Frost, *O.B.E.*, M.B. (10561), ret. pay, R.A.M.C. July 29, 1940.

Maj. G. D. Jameson (20698), R.A.M.C., is restd. to the rank of Lt.-Col. on reversion to ret. pay. May 15, 1941.

June 10.—The undermentioned at their own request, revert to the rank stated whilst empld. during the present emergency :—

As Majs. :—

Lt.-Col. C. E. W. S. Fawcett, M.B. (11041), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. C. Scaife, M.D. (11031), ret. pay (late R.A.M.C.). Apr. 3, 1940.

Lt.-Col. D. P. Watson, *D.S.O.*, M.B. (9931), ret. pay (late R.A.M.C.). Apr. 3, 1940.

June 13.—Lt.-Col. (temp. Col.) S. M. Hattersley, *M.C.*, M.D. (1809), from R.A.M.C., to be Col. June 6, 1941, with seniority. Sept. 20, 1938.

Lt.-Col. D. C. G. Ballingall, *M.C.*, M.B. (8521), retires on ret. pay on account of ill-health. June 4, 1941.

The undermentioned Majs. to be Lt.-Cols. :—

(Actg. Lt.-Col.) J. M. MacKenzie, *O.B.E.*, *M.C.*, M.B. (14371). June 4, 1941.

(Temp. Lt.-Col.) H. J. Bensted, *M.C.* (15778). June 6, 1941.

Regular Army Reserve of Officers.

May 27.—Capt. (temp. Maj.) P. G. Tuohy (5906), to be Bt.-Maj. Mar. 2, 1941, under the provs. of Art. 168, Royal Warrant for Pay and Promotion, 1940.

Lt. (War Subs. Capt.) C. G. Harper (150212), from Gordons (Res. of Off.) to be Lt. (War Subs. Capt.), Apr. 29, 1941, with seniority as Lt. Aug. 1, 1925.

TERRITORIAL ARMY.

June 6.—Maj. D. H. Lloyd-Williams (7765), from R.A.M.C. (temp. commn.), to be Maj. Sept. 2, 1939, with seniority July 11, 1935. (Substituted for notfn. in *Gazette* (Supplement) dated Dec. 5, 1939.)

Capt. E. H. Jaques, M.B. (62751), relinquishes his commn. on account of ill-health. June 7, 1941.

Capt. (Qr.-Mr.) W. N. Maddy (47245) relinquishes his commn. on account of ill-health, June 7, 1941, and retains his rank.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

May 20.—Sister Miss M. E. Lindsay resigns her appt. Apr. 30, 1941.

May 27.—The initials of Sister Miss J. F. M. Brims are as now described, and not as in the *Gazette* of Mar. 28, 1941.

The following Staff Nurses to be Sisters :—
Miss J. W. Dicks, Dec. 1, 1940, with seniority next below Miss M. Hellen.

Miss M. J. Busher, Dec. 23, 1940, with seniority next below Miss M. J. Verity.

The following members to rank as Sisters with seniority Jan. 30, 1941 :—

Miss M. M. Baldwin.
Miss I. D. Hearn.
Miss E. F. Shine.
Miss A. M. Baker.
Miss E. M. Talbot.

Miss R. M. N. Mansel.
Miss W. Wright.
Miss S. Rhys-Jones.
Miss D. St. J. Blackman.
Miss L. M. Holland.
Miss M. L. Holmes.

June 10.—The undermentioned Sisters resign their appts. :—

Miss E. E. MacDonald.	Oct. 31, 1940.
Miss J. R. R. Brown.	Jan. 17, 1941.
Miss M. H. Strickland.	Apr. 15, 1941.
Miss W. D. Lindsay-White.	May 20, 1941.

June 13.—The surname of Miss Rowan Muriel Nona MANSELL is as now described, and not as in the *Gazette* of Nov. 5, 1940, Apr. 8 and 25, 1941.

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

THE work of the Guild proceeds satisfactorily and many letters of appreciation are arriving from units which have received gifts. The Committee decided to give a further donation of £100 to provide comforts for Prisoners of War belonging to the

R.A.M.C. and A.D. Corps. It is felt that this decision will give much satisfaction to our many subscribers.

Headquarters Mess, Millbank, London, S.W.1.

DEATHS.

SUTTON.—In Tunbridge Wells, on Apr. 12, 1941, Major-General Alexander Arthur Sutton, *C.B.*, *D.S.O.*, late *R.A.M.C.*, Retired. Born Nov. 30, 1861, he took the *L.R.C.P. Edin.* and the *L.R.F.P.S. Glasgow* in 1884. Commissioned Surgeon Aug. 1, 1885, he was promoted Surgeon Major Aug. 1, 1897, Lieut. Colonel *R.A.M.C.* Aug. 1, 1905, Colonel Mar. 1, 1915, and Major-General Dec. 26, 1917. He retired Jan. 6, 1922. He served in the Protectorate Expedition in Sierra Leone 1898–1899 being severely wounded and receiving the Medal with Clasp. In South Africa he took part in the operations at Paardeberg (slightly wounded); actions at Poplar Grove, Karee Siding, Vet River, and Zand River; actions near Johannesburg, Pretoria, and Diamond Hill. Mentioned in despatches he was awarded the *D.S.O.*, Queen's Medal with four clasps and King's Medal with two Clasps. He served on the Staff as *D.D.M.S.* in Macedonia from 1915 till 1917. Twice mentioned in despatches he was created *C.B.* and awarded the Order of St. Sava, 3rd Class, 1914–15 Star, British War and Victory Medals. His two sons are serving in the Corps.

Capt. P. J. Martin, *R.A.M.C.*, writes :—

“ It was twenty-eight years ago that I

first met General Sutton when he arrived home from West Africa to assume command of the Royal Army Medical Corps Depot, at that time in Aldershot. I accompanied him to Salonika in 1915, where he was appointed *D.D.M.S.* Base and Lines of Communication Area, and although our paths differed from 1916 onwards, when he returned home to command the *R.A.M.C.* Depot at Blackpool, whence he retired, his charming personality made such an impression that the time I served with him has always been for me one of the happiest recollections of a lifetime spent in the Royal Army Medical Corps.

“ To know him was to love him. Literally thousands of officers and men of my generation in the Corps will mourn the loss of an ideal Commanding Officer, who invariably tempered his great powers of discipline with a friendliness and kindness of nature which only his inner knowledge of the men he commanded made possible.

“ With General Sutton the welfare of his men and their dependants was the first consideration. I remember him so well on the outbreak of the last war, when the depot at Aldershot had to take so many men of Kitchener's Army at such short notice. He worked unceasingly for their comfort and often remained with them

until the early hours of the morning until he saw them comfortably bedded for the night

"My generation was indeed fortunate in having such a man as guide and friend, and all of us who had the honour of serving under him owe him a debt of gratitude which can never be repaid.

"The thousands who knew him will grieve the passing of a great gentleman whose greatest concern was the well-being of the young soldier and whose enthusiastic zeal for the Corps, of which he was such an eminent member, he so successfully instilled into others."

AHERN.—In Dublin on May 10, 1941, Lieut.-Colonel Michael Ahern, *O.B.E.* Born Sept. 6, 1876, he took the L.R.C.P., L.R.C.S., Edinburgh, and the L.R.F.P.S. Glasgow, in 1902. Commissioned Lieut. R.A.M.C., Jan. 30, 1904, he was promoted Capt. July 30, 1907, Major July 1, 1915, and Lieut.-Colonel Aug. 18, 1926. He was employed under the Colonial Office on the Gold Coast from the end of 1924 till the beginning of 1927. He was awarded the *O.B.E.* in 1919. His sons Major T. M. R. Ahern and Capt. D. M. Ahern are serving in the Corps. His brother, Colonel David Ahern, *D.S.O.*, late R.A.M.C., who retired in 1935, rejoined on mobilization in 1939.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc., which should be in duplicate if possible according to King's Regulations.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps," will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints, or any lesser number to the extent applied for, will be made to contributors of Original Communications and of twenty-five excerpts, or any lesser number as above, in the case of Lectures, Travel, Clinical and other Notes, and Echoes of the Past. Such free reprints or excerpts will, however, only be sent to those specifying their wish to have them and a request for same should accompany the article when submitted for publication, stating the number of reprints or excerpts required.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

Communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.5, Hobart House, Grosvenor Place, S.W.1."

MANAGER'S NOTICES.

The Annual Subscription for the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is £1 payable in advance. Single copies, 2s. 6d. per copy.

Cheques, etc., should be made payable to the "Journal R.A.M.C.," and crossed "Holt & Co."

Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, Hobart House, Grosvenor Place, S.W.1."

ADVERTISEMENTS.

Communications regarding Advertisements should be addressed—
G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C.2.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

June 17.—The undermentioned Sisters resign their appointments:

Miss M. R. Terry. Mar. 21, 1941.

Miss A. B. P. Smele. June 1, 1941.

July 11.—The undermentioned Sisters resign their appts:

Miss H. Gourley. May 6, 1941.

Miss J. F. McKay. June 30, 1941.

July 15.—Sister Miss V. D. A. Powell, retires receiving a gratuity on account of ill-health. July 16, 1941.

APPOINTMENT VACANT.

COUNTY BOROUGH OF BIRKENHEAD.

CIVIL DEFENCE MEDICAL OFFICER.

Applications are invited from fully-qualified male Medical Practitioners for the Post of Medical Officer in Charge, Civil Defence Medical Services.

Salary at the rate of £750 per annum.

The Officer appointed will be required to reside within the Borough, and devote his whole time to the duties of the post.

The appointment will be for the duration of the war only. Retired Regular Army,

Navy and Air Force Medical Officers, and Practitioners who have had administrative Civil Defence Medical experience, will be regarded as specially eligible.

Applications, giving age, qualifications with dates, and record of experiences, together with copies of recent testimonials, should be sent immediately to Dr. D. Morley Mathieson, Medical Officer of Health, 9, Hamilton Square, Birkenhead, from whom any further particulars required regarding the appointment may be obtained.

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

It was with much regret that the Committee received the resignation of Lady MacArthur, the President and Honorary Treasurer of the Guild.

It was her energy and enthusiasm that brought the Guild into being in August last. Ever since she has been unsparing in her efforts to make it a success. She will be sadly missed.

We welcomed Mrs. Hood as a member of the Committee some months ago and it is hoped that she will consent to become our President.

Mrs. Garraway is the new Honorary Treasurer and her place as Honorary Secretary has been taken by Mrs. Richmond, with Mrs. Sandiford as Assistant Honorary Secretary.

We do hope that everyone will continue to support the Guild, both by subscribing and knitting, so that we can do much good work this winter.

Since our Notes last month a second cheque for £100 has been sent to the British Red Cross and St. John Ambulance Prisoners of War Fund. This has been gratefully acknowledged and they are again writing to the R.A.M.C. and A.D. Corps men in each camp to tell them that their parcels have been subscribed for by the Comforts Guild. We hope to send further sums as funds permit.

We received one or two unexpected windfalls last month—£20 from the proceeds of a collection made at a R.A.M.C. Band Concert at Chester and £15 from another at Shrewsbury. One unit has sent us two books

of savings stamps and another has decided to subscribe sixpence per head every month towards the Prisoners of War Fund. This is all most encouraging.

We have now despatched parcels of woollen comforts, books, games, &c., to the Middle East. We hope that they will arrive safely before the winter. There are still many units to be done. During the summer we have discontinued sending woollies at home, but we have kept up games and books to Field Units, who are very glad to receive them judging from the letters we have.

It is to be regretted that there has been so much delay over the Badges. Some have been received and have been sent to those who had applied for them. On ceasing to work for the Guild it is understood that the Badge will no longer be worn.

*R.A.M.C. Headquarters Mess,
Millbank, London, S.W.1.*

We publish the following letter sent to Lady MacArthur by the Director-General:

DEAR LADY MACARTHUR,

On your retirement from the Presidency of the Royal Army Medical Corps and The Army Dental Corps Comforts Guild, I should like to thank you on behalf of the Officers, Warrant Officers, Non-Commissioned Officers and Men of the Royal Army Medical Corps and The Army Dental Corps for all the great work you have done for the Guild,

By your initiative and inspiring leadership the Guild has brought bodily comfort and mental recreation to thousands of our men serving in all parts of the world.

To you, I am sure, it will be gratifying to know that the Guild through your untiring

efforts has become the successful organization that it is to-day.

Hobart House,
Grosvenor Place,
S.W.1.

August 14, 1941.

Believe me,
Yours sincerely,
(Signed) ALEX. HOOD.

DIED OF WOUNDS.

EASTON.—Captain Robert Thomson Easton, M.B., R.A.M.C., died of wounds in the Middle East in May, 1941. Born July 25, 1903, he was educated at Aberdeen, where he graduated M.B. in 1927. He had been House Surgeon and House Physician, Royal Infirmary, Oldham. Commissioned Lieutenant R.A.M.C. T.A., July 15, 1939,

he was promoted Captain July 15, 1940, with seniority Jan. 15, 1939.

GREATOREX.—Lieutenant Thomas William Greatorex, died in May, of wounds, in the Middle East. The only son of Dr. R. W. Greatorex of Halifax, he was born June 21, 1914, and commissioned Lieutenant (War Emergency Commission) R.A.M.C., Dec. 13, 1940.

DIED OF WOUNDS RECEIVED IN ACTION.

HAIR.—In April Lieutenant Alastair Hair, Elder son of the Rev. James and Mrs. Hair, of Edinburgh, he was born Sept. 25, 1904, and educated at Glasgow University, where he graduated M.B. in 1931. He had

been M.O.H. Llandrindod Wells since 1935. He was commissioned Lieutenant (War Emergency Commission) R.A.M.C., May 2, 1940.

KILLED.

BONNELL.—Acting Major Henry Emrys Bonnell, R.A.M.C., B.Sc., Wales, is reported in *The Times* as killed. Born Nov. 4, 1905, he was commissioned Lieutenant R.A.M.C. T.A. June 6, 1939, promoted Captain June 6, 1940, and had been appointed Temporary Major on Dec. 15, 1939. He took the M.R.C.S. and L.R.C.P. in 1931, and was Pathologist East Ham Memorial Hospital and Consulting Pathologist Runwell Hospital for Nervous Disorders, previous to which he had held the appointments of Assistant Pathologist Royal East Sussex Hospital, Hastings, and Clinical Pathologist King's College Hospital and Manchester Royal Infirmary.

promoted Captain April 19, 1940, and had been appointed Temporary Major Dec. 3, 1939.

WARD.—Major Richard Fowler Ward. Born Nov. 6, 1902, he was educated at the London Hospital. He took the M.B. London, in 1927, and the F.R.C.S. Edinburgh, in 1930. He was Honorary Surgeon in charge Uro-Genital Dept., East Suffolk and Ipswich Hospital, and had held the appointments of Clinical Assistant Out-Patients, London Hospital; Casualty Officer and House Surgeon East Suffolk and Ipswich Hospital and Senior House Surgeon Derbyshire Royal Infirmary. Commissioned Lieutenant R.A.M.C. T.A. Dec. 2, 1928, he was promoted Captain June 2, 1932, and Major Dec. 2, 1938.

ROUSE.—Temporary Major James Edward Colleton Rouse, R.A.M.C., was shown in *The Times* of July 2, 1941, as killed. Born Aug. 18, 1902, he was educated at St. George's Hospital, where he took the Brackenbury Surgical Prize. He took the M.B. London, in 1927, and the D.A. England, in 1936. He was Honorary Anaesthetist Worthing Hospital and Hove General Hospital; Honorary Medical Officer Royal Surrey County Hospital, and had been House Surgeon and House Physician and Resident Anaesthetist at St. George's Hospital. Commissioned Lieutenant in the R.A.M.C. Supplementary Reserve April 19, 1939, he was

WARDROP.—Temporary Major David Wardrop, R.A.M.C., has been shown in *The Times* of July 2, 1941, as killed. Born Nov. 30, 1904, he was commissioned Lieutenant (War Emergency Commission) R.A.M.C. June 6, 1940, and had been appointed Temporary Major Jan. 18, 1941. Educated at Birmingham and St. Mary's Hospital, he took the M.R.C.S. Eng., and the L.R.C.P. London, in 1928, and the F.R.C.S. Edinburgh in 1931. He had been Surgical Registrar, House Physician and House Surgeon of the General Hospital, Birmingham.

DEATHS.

POWER.—On June 23, 1940, Major Robert Ignatius Power, R.A.M.C., retired. Born July 31, 1857, he took the Licenses of the Royal Colleges of Physicians and Surgeons, Ireland, in 1881. Commissioned Surgeon May 30, 1885, he was promoted Surgeon Major May 30, 1897, and retired as Major May 30, 1905. He was employed when on the Retired List at Waterford from Sept. 1, 1905, till Jan. 31, 1918. He served in South Africa from 1900 till 1902 taking part in the action at Colesberg (Feb. 12, 1900); operations in the Orange Free State; action at Belfast (Aug. 26 and 27, 1900); operations on the Zululand Frontier of Natal in Sept. and Oct. 1901. He was awarded the Queen's Medal with three Clasps and the King's Medal with two Clasps.

ALDERSON.—While Prisoner of War, on Mar. 20, 1941, Major Christopher Rowland Alderson, M.C., M.M. Born in Bradford, Yorks, June 3, 1893, he joined the Liverpool Scottish in 1913 and transferred to the Royal Engineers in Sept. 1915, in which he was commissioned as Temporary Second Lieutenant, April 26, 1917, and promoted Temporary Lieutenant, Oct. 26, 1918. He relinquished his commission, retaining his rank of Lieutenant, Jan. 16, 1920. He served in France from Oct. 1914, till Sept. 1918, and in North Russia from March till Sept., 1919, being awarded the Military Medal—*London Gazette*, Oct. 21, 1916, and the Military Cross—*London Gazette*, Jan. 18, 1918. Taking the M.R.C.S. Eng., and the L.R.C.P. Lond., in 1925, he was Assistant Anæsthetist Eastbourne Ear, Throat and Nose Hospital and District Medical Officer, Eastbourne. Recommended Major R.A.M.C. T.A., April 26, 1939, he was shown missing June 19, 1940.

MOLESWORTH.—On May 22, 1941, Lieutenant-Colonel Robert Everard Molesworth, R.A.M.C., retired. Born July 7, 1861, he was commissioned Surgeon May 30, 1885, Surgeon Major May 30, 1897, and Lieutenant-Colonel R.A.M.C. May 30, 1905. He retired Mar. 6, 1907, and was re-employed Nov. 25, 1914, till Feb. 29, 1920, after which he accepted employment under the Foreign and Political Office, India, till Feb. 28, 1922.

In the South African War he took part in the Relief of Kimberley and the operations at Paardeberg (Feb. 17 to 26, 1900) being awarded the Queen's Medal with two Clasps.

STARR.—On active service in the Middle East, in May, 1941, Captain Donald Starr. Only son of Mr. and Mrs. J. Starr of Wigan, he was born on Mar. 25, 1902, and graduated M.B. Manchester, 1926. He had held the posts of House Surgeon at the Manchester

Royal Infirmary and Medical Officer of the Kent County Mental Hospital. He leaves a widow. He was commissioned Lieutenant (War Emergency Commission) R.A.M.C. Dec. 5, 1939, and promoted Captain Dec. 5, 1940.

PIKE.—In Lincoln on June 26, 1941, Major-General Sir William Watson Pike, K.C.M.G., D.S.O., F.R.C.S.I., late R.A.M.C., retired. Sir William was a son of William Pike, J.P., of Glendaray, Co. Mayo, where he was born on Mar. 10, 1860. He took the licenses of the Irish Colleges of Surgeons and Physicians in 1880 and the Fellowship of the former in 1888. Commissioned Surgeon Feb. 4, 1882, he was promoted Surgeon Major Feb. 4, 1894, Lieutenant-Colonel Feb. 4, 1902, Colonel Nov. 9, 1911, and, for distinguished service in the Field, Surgeon General June 3, 1917. He retired Mar. 10, 1920. A genial, fine-looking active man, he was four years an International Rugby player and also took part in inter-Provincial Irish Hockey. He was an expert shot with rifle and gun. He served in South Africa 1899–1902, taking part in the Relief of Kimberley; operations at Paardeberg (Feb. 17 to 24, 1900), actions at Poplar Grove and Dreifontein, and operations in the Transvaal and Cape Colony. Twice mentioned in despatches, he was awarded the D.S.O., Queen's Medal with five Clasps and King's Medal with two Clasps. He arrived from India in France in Dec., 1914, and served there first as D.D.M.S. Indian Cavalry Corps and subsequently as D.D.M.S. Indian Army Corps and D.M.S. 1 Army till Jan., 1917. He served on Special Commissions in East Africa in 1917–1918, and in India 1918–1919. Four times mentioned in despatches and brought to notice for valuable services rendered he was promoted Surgeon General, created C.M.G., K.C.M.G., Grand Officer Order of Avis and awarded the 1914–1915 Star, British War and Victory Medals.

LLOYD.—In St. Leonards-on-Sea, on July 5, 1941, Major-General Sir Owen Edward Pennefather Lloyd, V.C., K.C.B., late R.A.M.C., retired. Colonel Commandant R.A.M.C. 1922 to 1924.

Son of Major M. Pennefather Lloyd, 59 Regiment, of Co. Roscommon, he was born Jan. 1, 1854. Educated at Fermoy College and in Cork he took the L.R.C.P. and L.R.C.S. Edinburgh in 1877. He served for a short time in the Royal Scots Greys. Commissioned Surgeon Aug. 4, 1878, he was promoted Surgeon Major Aug. 4, 1890; Lieutenant-Colonel Aug. 4, 1898, Surgeon General Nov. 17, 1909, and retired Jan. 1, 1914. He was re-employed Jan. 22, 1915, till Mar. 31, 1918. He was

Honorary Surgeon to the Viceroy. Created C.B. in 1910, and K.C.B. 1923.

In 1894-1895 he was Medical Officer to the Franco-British Boundary Commission on the Mekong River. In 1898-1899 he was Medical Officer to the British Chinese Boundary Commission on the Burma Frontier and acted as H.B.M. Commissioner during the absence of Sir G. Scott.

Tall and spare ; always as hard as nails ; he was most popular. A non-meat eater ; he was the keenest of shots. In 1897 he killed 150 head of big game in Burma, including six tusker elephants. In South Africa 1879-1881 he took part in the Zulu campaign, including the storming and taking of Sekukukini's stronghold and the subsequent operations in the Zulu Mountains and in the Transvaal Campaign he went through the siege of Standerton. For the Zulu Campaign he was awarded the Medal with Clasp. He served in Burma in 1892 and 1893 in the operations in the Kachin Hills and was present at the attack on the Sima Post, where he won the Victoria Cross on Jan. 6, 1893—*London Gazette*, Jan. 2, 1894 : During the attack on the Sima Post by Kachins Surgeon-Major Lloyd, on hearing that the Commanding Officer, Captain Morton (who had left the fort to visit a picket about eighty yards distant), was wounded, at once ran out to his assistance under a close and heavy fire, accompanied by Subadar Matab Singh. On reaching the wounded officer, Surgeon Major Lloyd sent Subadar

Matab Singh back for further assistance, and remained with Captain Morton till the Subadar returned with five men of the Magwe Battalion of Military Police, when he assisted in carrying Captain Morton back to the fort where that officer died a few minutes afterwards. The enemy were within ten or fifteen paces, keeping up a heavy fire, which killed three men of the picket, and also Bugler Burna Singh. This man accompanied Captain Morton from the fort, showed great gallantry in supporting him in his arms when wounded, and was shot while helping to carry him back to the fort. (The native officer and five sepoy above alluded to were awarded the Order of Merit.) Sir Owen also received the Medal with Clasp.

During the war of 1914-1918 he was D.D.M.S. Southern Command and brought to notice for valuable services rendered.—War Office Communique, Sept. 18, 1917.

HAYWARD.—The death of Captain Frank Robert Oliver Hayward, R.A.M.C., is announced. Born Aug. 5, 1907, he was educated at Guy's Hospital and took the L.R.C.P. and M.R.C.S. in 1932. He was Honorary Anæsthetist at Chelmsford Hospital and had been House Physician of St. Bartholomew's Hospital, Rochester. Gazetted Lieutenant (War Emergency Commission) R.A.M.C., Nov. 3, 1939, he was promoted Captain (War Substantive) Nov. 3, 1940.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS

Corps News.

SEPTEMBER, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

July 18.—Capt. (temp. Maj.) M. J. Kohane (51322), to be Maj. May 14, 1941.

July 22.—The undermentioned Capts. to be Majs:

(Temp. Maj.) L. T. Furnivall (52313). June 29, 1941.

W. H. Hargreaves (53383). July 1, 1941.

July 29.—Lt.-Col. (temp. Col.) J. G. Ronaldson, M.C., M.B. (8452), having attained the age for retirement, retires July 28, 1941, and remains empld.

Maj. R. T. Cox, M.B. (15666), retires on ret. pay. July 27, 1941.

Maj. (temp. Lt.-Col.) W. Russell, M.C., M.B. (15662), to be Lt.-Col. July 28, 1941.

Col. W. R. Blackwell, C.B., C.M.G. (9798) (late R.A.M.C.), resumes the rank of Maj.-Gen. on ceasing to be re-empld. July 30, 1941.

August 1.—Lt.-Col. J. W. C. Stubbs, D.S.O., M.C., M.B. (4221), from R.A.M.C., to be Col. Aug. 1, 1941, with seniority Sept. 26, 1938.

Maj. G. S. Douglas (15706), to be Lt.-Col. Aug. 1, 1941.

Short Service Commission.—Capt. C. E. Watson (67839), retires, receiving a gratuity. Apr. 23, 1941. (Substituted for the notifn. regarding this officer's retirement, in the *Gazette* of May 27, 1941.)

August 8.—Lt.-Gen. Sir James A. Hartigan, K.C.B., C.M.G., D.S.O., M.B., D.Ch. (9990), ret. pay (late R.A.M.C.), is apptd. Col. Comdt. Aug. 8, 1941 (vice Lt.-Gen. Sir Harold B. Fawcus, K.C.B., C.M.G., D.S.O., D.C.L., M.B. (13345), ret. pay (late R.A.M.C.), who relinquishes the appt. on account of ill-health).

August 12.—Maj.-Gen. R. W. D. Leslie, C.B., O.B.E., K.H.P. (5372) (late R.A.M.C.), retires on ret. pay. Aug. 10, 1941.

Col. (temp. Brig.) C. M. Finny, O.B.E., M.B., F.R.C.S., K.H.S. (8132) (late R.A.M.C.), to be actg. Maj.-Gen. Aug. 10, 1941.

Lt.-Col. H. G. Winter, M.C. (8522), from R.A.M.C., to be Col. Aug. 10, 1941, with seniority Oct. 6, 1938.

The undermentioned (late R.A.M.C.), at their own request, revert to the rank of Maj. whilst empld. during the present emergency:

Col. T. S. Dudding, O.B.E. (9912), ret. pay. Oct. 9, 1940.

Lt.-Col. H. V. Stanley, M.C., M.B.E. (10296), ret. pay. Apr. 18, 1941.

Maj. (temp. Lt.-Col.) L. A. J. Graham (15677), to be Lt.-Col. Aug. 10, 1941.

August 15.—*Temporary Commission.*—War Subs. Capt. F. J. Fell (94536) relinquishes his commn. on account of ill-health, Aug. 16, 1941, and resumes the rank of Lt.

Regular Army Reserve of Officers.

July 29.—Maj.-Gen. W. R. Blackwell, C.B., C.M.G. (9798) (late R.A.M.C.), ceases to belong to the Res. of Off. on account of ill-health. July 30, 1941.

August 1.—Maj. W. R. O'Farrell (6100), having attained the age limit of liability to recall, ceases to belong to the Res. of Off. July 31, 1941.

August 19.—Lt. Anthony Beach Cowley, M.B. (178419), from R.A. Res. of Off., to be Lt. May 29, 1941, with seniority Jan. 17, 1925.

The KING has been graciously pleased to approve the publication of the names of the undermentioned as having been commended for brave conduct:

July 22.—Lieutenant Frederick Graham Millar, M.B. (136638).

TERRITORIAL ARMY.

July 22.—Maj. R. G. Addenbrooke, T.D. (32765), having attained the age limit, relinquishes his commn., and retains his rank. July 22, 1941.

War Subs. Capt. (Qr.-Mr.) W. P. Gegan (62324) relinquishes his commn. on account of ill-health. July 23, 1941.

THE ARMY DENTAL CORPS.

July 22.—Capt. R. A. Roth (28608) to be Bt. Maj. July 1, 1941.

having attained the age for retirement retires on ret. pay. July 23, 1941.

July 29.—Lt.-Col. B. W. Tyson (15729),

Maj. (temp. Lt.-Col.) J. Morrey (15634), to be Lt.-Col. July 23, 1941.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

August 1.—Sister Miss K. M. Lonergan, retires, receiving a gratuity. June 1, 1941.

Miss R. E. Veal. July 30, 1941.

The undermentioned Sisters resign their appts.:

Miss M. E. A. Fisher. July 22, 1941.

August 19.—The notifi. regarding Miss M. H. Strickland, in the *Gazette* of June 10, 1941, is cancelled.

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

THE work of the Guild proceeds satisfactorily, and many letters of appreciation have been received from various units for gifts. The Director of Voluntary Organizations has forwarded a letter from an R.A.M.C. officer, a Prisoner of War in Germany, thanking the Guild for 8 lb. of chocolate sent through the Red Cross which he distributed amongst his fellow members of the Corps at that particular camp.

Mrs. Clewer and said that if at any time she could be of any assistance to the Committee she would be only too happy to help; she particularly wished to thank Colonel Irvine for his invaluable assistance.

Mrs. Hood was welcomed by the Committee as President.

The Accounts of the Guild are being audited and a Balance Sheet will be published later.

At the last meeting August 12, 1941, Mrs. Clewer proposed a vote of thanks to Lady Mac Arthur for the magnificent work she has done on behalf of the Guild during her term of office as President. This was carried unanimously. Lady Mac Arthur thanked

In view of the scarcity of wool, the Hon. Secretary has written to Commands to find out what knitted garments they will want for the winter.

R.A.M.C. Headquarters Mess,
Millbank, London, S.W.1.

DEATHS ON ACTIVE SERVICE.

MOON.—Lieutenant Anthony James Moon, R.A.M.C., who was reported missing in S.S. *Lancastria*, in June, 1940, is now presumed killed. Born March 8, 1911, he took the M.R.C.S.Eng., and the L.R.C.P. Lond., in 1936, and the M.B., B.Ch.Cantab., in 1938. He was gazetted Lieutenant R.A.M.C. (W.S.) March 11, 1940. He had been in practice in Wallington, Surrey.

vice, of Captain L. P. Harte, The Army Dental Corps, will be received with deep regret by his many friends both in this country and in the United States of America. His name was first posted among those reported missing as a result of the operations in Greece, but information has subsequently been received of his death, presumably as a result of enemy action. Born on August 18, 1909, he was educated at Berkhamsted, Guy's Hospital, and Harvard University, qualified as L.D.S.Eng., in 1931, and subsequently visited the United States of America, where he specialized in oral and maxillo-facial surgery. After studying with Winter in St. Louis and Kazanjian in Boston he obtained the degree of D.M.D. Harvard. In this country he had also been closely associated with Kelsey Fry in pursuit of his desire to advance his knowledge of oral surgery. He was commissioned as a Lieutenant in The Army Dental Corps on November 27, 1939, and, after preliminary training in the Southern Command, was

MAXWELL.—Captain Robert Montgomery Maxwell, R.A.M.C. T.A., is reported in *The Times* of July 22, 1941, as having died of wounds. Born Dec. 6, 1909, he was educated in Glasgow, where he graduated M.B. in 1936. He was commissioned Lieutenant, R.A.M.C., T.A., May 20, 1939, and promoted Captain May 20, 1940.

HARTE.—On active service, Captain L. P. Harte, The Army Dental Corps.

A correspondent writes:

"The news of the death, on active ser-

posted, by virtue of his qualifications, as the dental officer to a general hospital which shortly embarked for Egypt. There he quickly gained an enviable reputation not only for his outstanding professional ability, but also as a keen officer of the best type. Promoted to the rank of

Captain on November 27, 1940, he was selected as one of the dental officers accompanying the forces operating in Greece, with, unhappily, such a tragic result. Harte leaves a widow and two young children to whom we extend our sincere sympathy."

DEATHS.

MORRIS.—In Boscombe on July 6, 1941, Colonel Arthur Hugh Morris, *C.I.E.*, *C.B.E.*, late *R.A.M.C.*, retired. Born Feb. 26, 1872, he was educated at St. Bartholomew's Hospital, and took the *M.R.C.S.* and *L.R.C.P.* in 1894, and the *D.P.H.* in 1905. Commissioned Surgeon Lieutenant July 29, 1896, he was promoted Captain *R.A.M.C.* July 29, 1899, Major Jan. 29, 1908, Lieutenant-Colonel March 1, 1915, Colonel Dec. 26, 1917, and retired Sept. 5, 1922. He served on the Hospital Ship *Hardinge* during the Somaliland Campaign of 1903 receiving the Medal with Clasp. He served in France and Belgium in 1916 and 1917 and was brought to notice for valuable services rendered in War Office Communique Sept. 18, 1917, and twice mentioned in despatches in *London Gazette* of Dec. 24, 1917, and June 5, 1919. He was created *C.B.E.* and received the British War and Victory Medals. He served in Mesopotamia from 1918 till 1922. Mentioned for his services during the rebellion there in despatches *London Gazette* Sept. 9, 1921, he was created *C.I.E.*, and received the Iraq Medal with Clasp.

GEE.—On July 12, 1941, at Gleneagles Hospital, Captain S. W. Gee, The Army Dental Corps. Born on May 8, 1906, he was educated at Preston Grammar School and the University of Liverpool and qualified as a dental surgeon in 1927. Prior to joining The Army Dental Corps, he held an appointment as a school dental officer with the Lancashire County Council. He was commissioned as a Lieutenant in The Army Dental Corps on June 18, 1940, and served in the Scottish Command, being promoted to the rank of Captain on June 18, 1941. He leaves a widow and two small

sons to whom we extend our sincere sympathy in their bereavement.

MORE.—In London on July 19, 1941, Colonel Lancelot Paxton More, late *R.A.M.C.*, retired. Born in Rothwell, Northants, March 20, 1869, he was educated at Edinburgh, where he was a demonstrator of Practical Pathology, and where he took the *M.B.* in 1891. Commissioned Surgeon Lieutenant July 27, 1892, he was promoted Surgeon Captain July 27, 1895, Major *R.A.M.C.* July 27, 1904, Lieutenant-Colonel Feb. 22, 1915, Brevet Colonel Jan. 1, 1917, Colonel June 2, 1918, and retired July 5, 1922. He served on the North-West Frontier of India in 1897 and 1898, including the Tirah Campaign and was awarded the Medal with two Clasps. He served in India during the Great War and received the Brevet of Colonel in the New Year Honours of 1917.

WARING.—In Whitegates, Maresfield, on Aug. 9, 1941, Colonel Anthony Henry Waring, *D.S.O.*, late *R.A.M.C.*, retired. Son of the late Henry R. Waring, Palma-de-Mallorca, Spain, he was born Nov. 28, 1871, and educated at University College, London. He took the *M.R.C.S.Eng.*, and the *L.R.C.P.Lond.*, in 1895. Commissioned Surgeon Lieutenant Jan. 29, 1896, he was promoted Captain *R.A.M.C.*, Jan. 29, 1899, Major Jan. 29, 1908, Lieutenant-Colonel March 1, 1915, and Colonel Oct. 15, 1918. He was placed on half pay Nov. 26, 1919, and retired Jan. 8, 1921, on account of ill-health. He served in France the whole of the Great War, being twice mentioned in despatches, awarded the *D.S.O.*, 1914 Star, British War and Victory Medals and created a Commander of the Military Order of Avis (Portugal).

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc., which should be in duplicate if possible according to King's Regulations.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps," will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints, or any lesser number to the extent applied for, will be made to contributors of Original Communications and of twenty-five excerpts, or any lesser number as above, in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past. Such free reprints or excerpts will, however, only be sent to those specifying their wish to have them and a request for same should accompany the article when submitted for publication, stating the number of reprints or excerpts required.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS

Corps News.

OCTOBER, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

Aug. 22.—Lt.-Gen. A. Hood, *C.B.E.*, M.D. (18164), (late R.A.M.C.), to be Hon. Physician to His Majesty Aug. 1, 1941 (vice Lt.-Gen. Sir William P. MacArthur, *K.C.B.*, *D.S.O.*, *O.B.E.*, M.D., D.Sc., F.R.C.P., F.R.C.P.I. (15), (late R.A.M.C.), who has retired).

Aug. 26.—Maj.-Gen. H. P. W. Barrow, *C.B.*, *C.M.G.*, *D.S.O.*, *O.B.E.* (26352), ret. pay (late R.A.M.C.), is apptd. Col. Comdt., Aug. 27, 1941 (vice Maj.-Gen. R. S. Hannay, *C.B.*, *C.M.G.*, *D.S.O.* 10033), ret. pay (late R.A.M.C.), who has attained the age limit for the appt.).

Short Service Commission.—Lt. C. D. Cruickshank (144552), to be Capt. Aug. 18, 1941.

Aug. 29.—Lt.-Col. R. G. Martyn, M.B. (8715), retires Aug. 25, 1941, and remains empld.

Maj. (temp. Lt.-Col.) W. Bruce, *O.B.E.*, M.B. (10096), to be Lt.-Col. Aug. 25, 1941.

Short Service Commission.—The appt. of Lt. J. A. Farrell (85409) is antedated to Feb. 1, 1938, under the provs. of Art. 39, Royal Warrant for Pay and Promotion, 1940, but not to carry pay and allces. prior to Feb. 1, 1939.

Lt. J. A. Farrell (85409) to be Capt. Feb. 1, 1940, with seniority Feb. 1, 1939. (Substituted for the notifn. in the *Gazette* of Feb. 20, 1940.)

Sept. 2. — The undermentioned Capts. (temp. Majs.) to be Majs. :

T. M. R. Ahern, M.B. (52443). July 28, 1941.

R. Johnston, M.B. (52437). July 28, 1941.

J. B. MacFarlane, M.B. (51983). Aug. 1, 1941.

Lt.-Col. C. J. Blaikie (14909), R.A.M.C., at his own request, reverts to the rank of Maj. whilst empld. during the present emergency. July 29, 1941.

Sept. 5.—Capt. D. B. O'Sullivan-Beaure, M.B. (39246), h.p. list (late R.A.M.C.), retires on account of ill-health, receiving a gratuity. Aug. 21, 1941.

Sept. 9.—Maj. S. J. A. Walshe, *D.S.O.* (1641), ret. pay (late R.A.M.C.), is restd. to the rank of Lt.-Col. on ceasing to be empld. Sept. 7, 1941.

The undermentioned Capts. to be Majs. :

(Temp. Maj.) J. C. Barnetson, M.B. (41955). July 28, 1941.

(Temp. Maj.) H. J. R. Thorne, M.B. (51399). Aug. 4, 1941.

(Actg. Maj.) B. Blewitt, M.B. (52441). Aug. 17, 1941.

(Temp. Maj.) T. J. Moloney, M.B. (51371). Sept. 2, 1941.

Sept. 12.—Maj.-Gen. P. S. Tomlinson, *C.B.*, *D.S.O.*, M.R.C.P. (5847), late R.A.M.C., is appt. Hon. Physician to the King, Aug. 10, 1941, vice Maj.-Gen. R. W. D. Leslie, *C.B.*, *O.B.E.* (5372), late R.A.M.C., who has retired.

Short Service Commission.—Capt. A. F. Murray, M.B. (65401), forfeits nine months' service for the purposes of promotion. Mar. 17, 1941.

Temporary Commission.—Maj. P. N. Creagh (42191), relinquishes his commn. Sept. 11, 1941, and retains the rank of Maj.

Regular Army Reserve of Officers.

Sept. 9.—Col. R. A. Bryden, *D.S.O.* (11038) (late R.A.M.C.), ceases to belong to the Res. of Off. on account of ill-health. Sept. 10, 1941.

TERRITORIAL ARMY.

Aug. 29.—The KING has been graciously pleased to confer "The Efficiency Decoration" upon the following officers of the Territorial Army:

Colonel A. R. Laurie, M.B. (34416).
Lieutenant-Colonel D. W. E. Burridge, M.B. (21939).
Lieutenant-Colonel T. E. A. Carr, M.B. (40097).

Lieutenant-Colonel W. A. Ramsay, M.B. (31442).

Lieutenant-Colonel A. B. Williamson, M.D. (20428).

Major (temporary Lieutenant-Colonel) A. S. Pern (25932).

Major (temporary Lieutenant-Colonel) R. O. Townend (32653).

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

Sept. 2.—The undermentioned Sisters resign their appts.:

Miss C. Smyth. July 8, 1941.

Miss C. C. Anderson. Aug. 13, 1941.

Sept. 5.—Sister Miss M. McGregor retires on ret. pay on account of ill-health. *Sept. 6, 1941.*

Sept. 9.—Sister Miss H. M. Smith, retires

on ret. pay on account of ill-health. *Sept. 10, 1941.*

The undermentioned Sisters resign their appts.:

Miss J. M. Hill. Aug. 31, 1941.

Miss C. A. Butler. *Sept. 1, 1941.*

Sept. 12.—Principal Matron Miss M. G. Kennedy, R.R.C., retires on ret. pay. *Sept. 12, 1941.*

COLONEL COMMANDANT, R.A.M.C.

Major-General Harold Percy Waller Barrow, *C.B., C.M.G., D.S.O., O.B.E.*, was appointed Colonel Commandant, R.A.M.C., August 27, 1941. It is interesting to note

that his grandfather, Inspector-General Thomas Waller Barrow, was gazetted Assistant Surgeon 2 Foot just a century ago—on June 8, 1841.

EXTRACT FROM WESTERN COMMAND ORDERS.

BY THE GENERAL OFFICER COMMANDING-IN-CHIEF, WESTERN COMMAND,
DATED THURSDAY, AUGUST 14, 1941.

"The General Officer Commanding-in-Chief wishes to express his appreciation of the courage and fine example displayed by the undermentioned:

Personnel of No. 6 Army Dental Laboratory, A.D. Corps.

Men of No. 6 Army Dental Laboratory, A.D. Corps, did fine work during an enemy air-raid when, after incendiaries had been

dropped, their co-operation saved part of a hospital from more severe damage. Their efforts secured equipment valued at some £5,000. They also freed a number of civilians trapped in a basement cellar which had been almost totally demolished by H.E., and on a third occasion gave excellent assistance when a land mine shattered a number of houses."

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

THE Committee have pleasure in publishing the Balance Sheet of the Guild up to the end of July, 1941.

Since that date, a further sum of £200 has been sent to the Prisoners of War Fund of the British Red Cross and Order of St. John. Of this, £100 was granted from the General Funds, and £100 was given by No. 16 Coy. R.A.M.C. and Military Hospital, Davyholme, Lancashire.

We have nearly completed our parcels for the units in the Middle East.

The number of knitted garments received has fallen off considerably, and the Committee hopes, that with longer evenings, more will soon be forthcoming. We can supply the wool if you will do the knitting.

R.A.M.C. Headquarters Mess,

Millbank,

London, S.W.1.

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST JULY, 1941.

To Receipts :	£	s.	d.	£	s.	d.	By Payments :	£	s.	d.	£	s.	d.
Donations :							Comforts :						
Royal Army							Wool ..	504	0	0			
Medical Corps 1,795 7 7							Books ..	84	0	0			
The Army Dental Corps ..	488	8	2	2,283	15	9	Games ..	312	8	8			
							Other Comforts	52	19	11			
											953	8	7
							Donation :						
							British Red						
							Cross and St.						
							John Prison-				200	0	0
							ers of War						
							Office and Distri-						
							bution Expen-						
							ses :						
							Taxi Fares and						
							Travelling	13	12	1			
							Stamps and						
							Stationery	28	1	1½			
							Parcel Post	17	16	4½			
							Packing Ex-						
							penses ..	8	13	8			
							Cheque Books	0	13	3			
							Sundry Expenses	3	17	0			
											72	13	6
							Cash at Bank and						
							in Hand :						
							At Bank—						
							Glyn Mills						
							& Co. ..	1,046	4	8			
							In Hands of						
							Honorary						
							Officials ..	11	9	0			
											1,057	13	8
											£2,283	15	9

We have prepared the above Receipts and Payments Account from the books, accounts and vouchers of the Guild and certify the same to be correct in accordance therewith.

83, CANNON STREET,
LONDON, E.C.4.
23rd September, 1941.

HEMSLEY MILLER & Co.,
Chartered Accountants.

DEATH.

SLOAN.—In Ifield, Sussex, on Sept. 10, 1941, Major-General John Macfarlane Sloan, C.B., C.M.G., D.S.O., late R.A.M.C., Retired. Son of Samuel Sloan, M.D., Glasgow, he was born July 22, 1872, and educated at Glasgow University where he graduated M.B., B.Ch., in 1898. Commissioned Lieutenant Jan. 28, 1899, he was promoted Captain July 28, 1902. He was Adjutant, Sch. of Instruction, Highland Division, T.F., June 12, 1908, to Oct. 31, 1911. He was promoted Major Oct. 28, 1910, Brevet Lieutenant-Colonel Feb. 18, 1915, substantive Lieutenant-Colonel March 1, 1915, Brevet Colonel Jan. 1, 1916, substantive Colonel Dec. 26, 1923,

and Major-General Oct. 4, 1926. He was D.D.M.S., Southern Command, India, from Oct. 30, 1926, till he retired. Created C.B., 1927, he retired Oct. 13, 1929. A fine upstanding man he was a thorough good fellow. He served in the South African Campaign and took part in the Defence of Ladysmith, including the sorties of Dec. 7 and 10, 1899, and the action at Wagon Hill on Jan. 6, 1900. He followed on with the Army through Natal (March to June, 1900) and into the Transvaal. He also took part in the operations in the Orange River Colony. He was mentioned in Despatches, *London Gazette*, Jan. 17, 1902, for distinguished

good service in Colonel Benson's action at Baakenlaagte on Oct. 30, 1901, and was awarded the *D.S.O.* for devotion to duty there. He received the Queen's Medal with four Clasps and the King's Medal with two Clasps. In the war of 1914-1918 he served in France from Aug. 1914, till Jan. 1916, and in Mesopotamia from Jan.

1916, till the end of the war. In Mesopotamia he was *A.D.M.S.* and later *D.D.M.S.* Six times mentioned in despatches he was awarded Brevets of Lieutenant-Colonel and Colonel; created *C.M.G.*; received the Order of St. Anne 2nd Class with Swords, 1914 Star and Clasp, British War and Victory Medals.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc., which should be in duplicate if possible according to King's Regulations.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a *nom-de-plume*.

All Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps," will (unless the Author notifies at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

A free issue of twenty-five reprints, or any lesser number to the extent applied for, will be made to contributors of Original Communications and of twenty-five excerpts, or any lesser number as above, in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past. Such free reprints or excerpts will, however, only be sent to those specifying their wish to have them and a request for same should accompany the article when submitted for publication, stating the number of reprints or excerpts required.

Reprints or excerpts, additional to the above, can be furnished on payment if specially ordered at the time of submission of the article for publication.

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MANAGER'S NOTICES.

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Communications in regard to subscriptions, change of address, etc., should be addressed "THE MANAGER, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.2, Hobart House, Grosvenor Place, S.W.1."

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G. STREET & CO., LTD., 8, SERLE STREET, LONDON, W.C.2.

JOURNAL

OF THE

ROYAL ARMY MEDICAL CORPS

Corps News.

NOVEMBER, 1941.

EXTRACTS FROM THE "LONDON GAZETTE."

July 1.—The KING has been graciously pleased on the occasion of the Celebration of His Majesty's Birthday, to give orders for the following promotions in, and appointments to, the Most Honourable Order of the Bath :

To be Additional Members of the Military Division of the Third Class, or Companions of the said Most Honourable Order :

Major-General Robert Cecil Priest, M.D., F.R.C.P., K.H.P., late Royal Army Medical Corps.

The KING has been graciously pleased, on the occasion of the celebration of His Majesty's Birthday, to give orders for the following promotions in, and appointments to, the Most Excellent Order of the British Empire :

To be Additional Officers of the Military Division of the said Most Excellent Order :

Major (temporary Lieutenant-Colonel) William Ralston Duncan Hamilton, M.B., Royal Army Medical Corps.

To be Additional Members of the Military Division of the said Most Excellent Order :

Lieutenant (Quartermaster) Joseph John Bicknell, Royal Army Medical Corps.

Lieutenant (temporary Major) George Jameson-Carr, M.B., Royal Army Medical Corps.

Captain (Quartermaster) Watkin Norman Maddy, late Royal Army Medical Corps.

July 8.—The KING has been graciously pleased to give orders for the following appointments to the Most Honourable Order of the Bath, in recognition of distinguished services in the Middle East during the period December, 1940, to February, 1941 :

To be Additional Members of the Military Division of the Third Class, or Companions of the said Most Honourable Order :

Colonel (temporary Major-General) Percy Stanley Tomlinson, D.S.O., M.R.C.P., late Royal Army Medical Corps.

Sept. 19.—Col. W. B. Rennie, M.C., M.B. (11015) (late R.A.M.C.), having attained the age for retirement, retires and remains empld. Sept. 20, 1941.

Lt.-Col. (temp. Col.) N. Cantlie, M.C., M.B., F.R.C.S. (4217), from R.A.M.C., to be Col. Sept. 20, 1941, with seniority Oct. 6, 1938.

Maj. (temp. Lt.-Col.) L. B. Clarke (15665), to be Lt.-Col. Sept. 20, 1941.

Sept. 23.—Col. (temp. Brig.) W. Bisset, M.C., M.B. (15684) (late R.A.M.C.), having attained age for retirement, retires Sept. 24, 1941, and remains empld.

Lt.-Col. E. A. P. Brock (8569), from R.A.M.C., to be Col. Sept. 24, 1941, with seniority Jan. 1, 1938.

Maj. (temp. Lt.-Col.) J. C. Denvir, M.B. (19372), to be Lt.-Col. Sept. 24, 1941.

Sept. 26.—Col. W. A. Frost, O.B.E., M.B. (615), (late R.A.M.C.), retires on ret. pay on account of ill-health. Sept. 27, 1941.

Lt.-Col. E. Phillips, D.S.O., M.C., M.B. (8555), from R.A.M.C., to be Col. Sept. 27, 1941, with seniority Nov. 17, 1938.

Maj. J. E. Brooks, M.B. (24829), to be Lt.-Col. Sept. 27, 1941.

Sept. 30.—Col. (temp. Brig.) A. D. Stirling, D.S.O., M.B. (4623), (late R.A.M.C.), retires Sept. 30, 1941, and remains empld.

Lt.-Col. (temp. Col.) S. D. Reid, M.B. (5716), from R.A.M.C., to be Col., Sept. 30, 1941, with seniority Nov. 22, 1938.

Maj. (temp. Lt.-Col.) W. J. Robertson, M.B. (14375), to be Lt.-Col. Sept. 30, 1941.

Lt. (Qr.-Mr.) H. W. Reeves (66209), to be Capt. (Qr.-Mr.) Oct. 1, 1941.

Oct. 3.—Lt.-Col. S. P. Sykes, M.B. (18796), at his own request, reverts to the rank of Maj. whilst empld. during present emergency. Sept. 8, 1941.

Oct. 7.—Lt.-Col. (temp. Col.) E. A. Sutton, M.C. (8525), from R.A.M.C., to be Col., Oct. 8, 1941, with seniority Dec. 30, 1938.

Maj. & Bt. Lt.-Col. (temp. Lt.-Col.) F. C. Tibbs (15776), to be Lt.-Col. Oct. 8, 1941.

Oct. 10.—Col. H. C. Winckworth (127), ret. (late R.A.M.C.), at his own request, reverts to the rank of Lt.-Col. whilst empld. during the present emergency. Aug. 28, 1941.

Oct. 14.—The undermentioned (late R.A.M.C.), retire on ret. pay. Oct. 13, 1941 :

Maj.-Gen. A. D. Fraser, *D.S.O.*, *M.C.*, *M.B.*, *K.H.S.* (11112).

Maj.-Gen. (supernumerary) R. C. Priest, *C.B.*, *M.D.*, *F.R.C.P.*, *K.H.P.* (14073).

Col. (actg. Maj.-Gen.) C. M. Finny, *O.B.E.*, *M.B.*, *F.R.C.S.*, *K.H.S.* (8132) (late *R.A.M.C.*), to be Maj.-Gen. Oct. 13, 1941.

Col. (temp. Brig.) G. Wilson, *O.B.E.*, *M.C.*, *M.B.*, (26291) (late *R.A.M.C.*), to be actg. Maj.-Gen. Oct. 13, 1941.

The undermentioned Lt.-Cols., from *R.A.M.C.*, to be Cols. Oct. 13, 1941 :

F. D. Annesley, *M.C.* (8422), with seniority Mar. 18, 1939.

C. D. M. Buckley, *M.C.*, *M.B.* (22509), with seniority Mar. 20, 1939.

Maj.-Gen. R. C. Priest, *C.B.*, *M.D.*, *F.R.C.P.*, *K.H.P.* (14073), relinquishes the appt. of Insp. of Med. Servs. Oct. 13, 1941.

The undermentioned Majs. to be Lt.-Cols. Oct. 13, 1941 :

(Temp. Lt.-Col.) F. R. H. Mollan, *M.C.* (5666).

G. O. F. Alley, *M.C.*, *M.D.* (14138).

Maj.-Gen. R. C. Priest, *C.B.*, *M.D.*, *F.R.C.P.* (14073), ret. pay, at his own request, reverts to the rank of Col. whilst empld. during the present emergency. Oct. 13, 1941.

Oct. 17.—Maj. J. M. Morrison, *M.B.* (15603), retires on ret. pay on account of ill-health. Oct. 4, 1941.

Maj. F. P. M. Anderson, *M.B.* (35616), to take rank and precedence in his Corps and in the Army, as if his appt. as Maj. bore date July 27, 1937.

Lt. (Qr.-Mr.) F. T. Catton (66318), to be Capt. (Qr.-Mr.) Oct. 16, 1941.

Regular Army Reserve of Officers.

Oct. 17.—Maj. J. Hare, *O.B.E.*, *M.D.*, *F.R.F.P.S.* (26292), ceases to belong to the Res. of Off. on account of ill-health, Oct. 18, 1941, and is granted the rank of Lt.-Col.

THE ARMY DENTAL CORPS.

Oct. 14.—Maj. A. A. McMullan (34239), is removed from the Res. of Off. Sept. 15, 1941, under the provs. of Art. 716a, Royal Warrant for Pay and Promotion, 1940.

Oct. 17.—Maj. (temp. Lt.-Col.) H. J. Higgins (15754), to be Lt.-Col. Oct. 17, 1941.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

Sept. 19.—Matron (Act. Principal Matron) Miss M. Loughnan, *R.R.C.*, to be Principal Matron. Sept. 18, 1941.

The undermentioned Sisters (temp. Matrons) to be Matrons :

Miss G. Miller, *A.R.R.C.* Sept. 12, 1941.

Miss A. McC. Summerfield. Sept. 18, 1941.

Oct. 14.—Matron Miss H. M. Jones, *R.R.C.*, retires on ret. pay. Sept. 17, 1941.

Sister (temp. Matron) Miss S. A. Perry, to be Matron. Sept. 17, 1941.

BRITISH RED CROSS SOCIETY—PRISONERS OF WAR DEPARTMENT.

THE Officers of the Royal Army Medical Corps have made a further donation of £100

to the British Red Cross Society, Prisoners of War Department, making a total of £300.

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

THERE has not been much to report since the last issue of the JOURNAL. A further contribution is being sent to our Prisoners of War this month and also a sum earmarked for books and games. The amounts will be voted at the next Committee Meeting.

We have this week received several letters from the Middle East from Field Units, to whom we despatched parcels in February

last. We were very glad to hear of their safe arrival and that the men seemed so pleased with them. Parcels have been sent every month since then, and we have now sent a parcel to every unit in the Middle East.

The Committee will be very glad to hear from any newly formed units, or those under orders to proceed overseas, who would like

books and games, and woollies too, where necessary.

We still want more knitters and can supply wool to parties, coupon-free and without cost, provided the garments are returned to the Headquarters Mess. Applications for wool

should be addressed to Mrs. Sandiford, R.A.M.C. Headquarter Mess, Millbank, S.W.1.

*R.A.M.C. Headquarters Mess,
Millbank,
London, S.W.1.*

DEATHS.

GILL.—On Aug. 27, 1941, Captain H. Gill, The Army Dental Corps. Qualified as L.D.S., Sheffield, in 1934, and before joining the Army held the appointment of Honorary Assistant Dental Surgeon to the Barnsley Beckett Hospital. He was commissioned as Lieutenant in the Army Dental Corps on Aug. 12, 1940, and promoted Captain a year later. Captain Gill, who was 36 years of age, leaves a widow and a small son to whom we extend our deep sympathy.

TOWNEND. On Aug. 28, 1941, Captain A. F. Townend, The Army Dental Corps, at the age of 29 years. He was educated at Bradford and qualified as L.D.S., Leeds, in 1935. He was commissioned as Lieutenant in The Army Dental Corps on June 4, 1940, and promoted Captain on June 4, 1941. Captain Townend was unmarried.

BARNETT.—On Aug. 31, 1941, in Beaconsfield, Lieut.-Colonel Kenneth Bruce Barnett, R.A.M.C., retired. Born in Holywood, Belfast, Sept. 22, 1867, he was educated at Queen's College, Belfast and took the M.B., R.U.I., in 1892, and the F.R.C.S.I., in 1904. He entered the Service as Surg. Lieut. Jan. 29, 1894, and was promoted Surg. Capt. Jan. 29, 1897. Becoming Major R.A.M.C. Oct. 29, 1905, he was promoted Lieut.-Colonel Mar. 1, 1915, and retired Sept. 5, 1919. He contributed articles to the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, the *British Medical Journal* and *Indian Medical Gazette*. He compiled the Handbook on military sanitation for regular officers in 1912. He served on the North West Frontier in the Tirah Expedition of 1897 and was awarded the medal with two Clasps, having taken part in the action at Dargai, capture of the Sampagha and Arhanga Passes and operations in the Bazar Valley Dec. 25 to 30, 1897. In 1914 and 1915 he served in France and in 1917 and 1918 in Macedonia. He was awarded the 1914 Star, the British War and Victory Medals.

WOOD.—On Sept. 27, 1941, Colonel Leonard Wood, late R.A.M.C., retired, of the Garth, Westbury, Wilts. Born in Uttoxeter on July 30, 1874, he was educated at Wellington College, Berkshire, and took the M.R.C.S. and L.R.C.P. London, in 1898. Commissioned Lieut. R.A.M.C. July 27,

1899, he was promoted Capt. July 27, 1902, Major, April 27, 1911, Lieut.-Colonel, March 1, 1915, Colonel, June 1, 1926, and retired June 1, 1930.

He was Adjutant, School of Instruction, East Lancashire Division, T.F. from Oct. 30, 1908 till Oct. 1, 1911, and on promotion to Colonel in 1926 he became D.D.M.S., Egypt and the Sudan, and was D.D.M.S., Scottish Command, from Dec. 8, 1926, till he retired. After retirement he held the retired pay appointment at Trowbridge from Jan. 1, 1932 till July 28, 1939. In the South African Campaign he took part in the Relief of Kimberley, operations at Paardeberg and action at Dreifontein earning the admiration of all ranks and being recommended for some special recognition of his services. He received the Queen's Medal with three Clasps and the King's Medal with two Clasps. He served in Mesopotamia from the latter part of 1915 till April 1917, being awarded the 1914-15 Star, British War and Victory Medals.

O'CONNELL.—On Oct. 2, 1941, in West Moors, Dorset, Colonel David Valentine O'Connell, late R.A.M.C., retired. Born in Cahirciveen, Co. Kerry, Feb. 13, 1858, he was educated at Queen's College, Galway, and graduated M.D. in 1881 and M.Ch. in 1882 at the old Royal University of Ireland. He took the D.P.H., Cambridge, in 1893. Gazetted Surgeon Feb. 2, 1884, he was promoted Surgeon Major Feb. 2, 1896, Lieut.-Colonel R.A.M.C., Feb. 2, 1904, and retired Feb. 13, 1913. Recalled Nov. 6, 1914, he was made Brevet Colonel June 3, 1917, and relegated to unemployment April 16, 1919. On Nov. 23, 1920, he was appointed to the retired pay appointment at Bury St. Edmunds. During the operations in Crete in 1897 he was in charge of a Field Hospital at Candia. He married the granddaughter of Inspector General James Forbes, M.D., founder of the R.A.M.C. H.Q. Mess, who served in the retreat to Corunna. His son Lieut. John Forbes O'Connell, R.A.M.C., was killed in action at the battle of the Aisne in 1914.

DAVIDSON.—In Aberdeen on Oct. 12, 1941, Lieut.-Colonel Hugh Allan Davidson, D.S.O., R.A.M.C., retired. Born in Aberdeen May 25, 1875, he graduated M.B.

there in 1900. He entered the R.A.M.C. Nov. 29, 1900. Promoted Capt. Nov. 29, 1903, Major Aug. 29, 1912, and Lieut.-Colonel Sept. 13, 1918; he retired April 29, 1920. He served in France from Sept. 1915 till the end of the war. Twice mentioned in despatches he was awarded the French War Cross and *D.S.O* and Bar; the Bar to the *D.S.O* was awarded for

conspicuous gallantry and devotion to duty. When in command of his unit he maintained the advanced dressing station in spite of heavy shelling by the enemy, only withdrawing when ordered to do so. He visited the Regimental Aid Posts under heavy shelling, and by his example and energy many casualties were evacuated which otherwise might have been lost.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. All such articles or papers, etc., intended for publication must be submitted **in duplicate** through the proper channels, i.e., Commanding Officer and A.D.M.S., or D.D.M.S., to the Under-Secretary of State, War Office (P.R. (O)), and not to A.M.D.2, otherwise such articles are liable to be returned to the authors and this may cause delay in publication.

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The fact that goods made of raw materials in short supply owing to war conditions are advertised in the Journal should not be taken as an indication that they are necessarily available for export.

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Page 21 is on joint
✓ of index

Maj.-Gen. A. D. Fraser, *D.S.O.*, *M.C.*, M.B. (1112) (late R.A.M.C.), retired).

Col. (temp. Brig.) D. T. Richardson, *M.C.*, M.B. (3014) (late R.A.M.C.), Oct. 29, 1941 (vice Maj.-Gen. F. Casement, *D.S.O.*, M.B. (8370) (late R.A.M.C.), retired).

Regular Army Reserve of Officers.

Nov. 7.—Capt. K. L. O'Sullivan (10052), to be Bt. Maj. Aug. 12, 1941, under the provs. of Article 168, Royal Warrant for Pay and Promotion, 1940.

THE ARMY DENTAL CORPS.

Oct. 28.—The undermentioned, having attained the age for retirement, retire on ret. pay :

Lt.-Col. (actg. Col.) J. S. Smith (19379). Oct. 17, 1941.

Maj. C. H. Pywell (10252). Oct. 26, 1941.

QUEEN ALEXANDRA'S IMPERIAL MILITARY NURSING SERVICE.

Oct. 31.—The undermentioned Sisters resign their appts. :

Miss M. K. Finch-Noyes. Sept. 8, 1941.

Miss E. M. Leicester.

Sept. 15, 1941.

Miss O. N. Pocock.

Oct. 1, 1941.

Miss G. K. Roberts.

Oct. 31, 1941.

LUNCHEON AT R.A.M.C. HEADQUARTERS MESS.

On Wednesday, November 19, 1941, the Director-General, Army Medical Services, and officers, Royal Army Medical Corps, entertained a distinguished company to an informal luncheon in the R.A.M.C. Headquarters Mess, Millbank. The guests were all in one way or another associated with the war-time activities of the Army Medical Services.

Both Medical and Dental professions were represented.

The guests on arrival were received in the Smoking Room by Lt.-Gen. A. Hood, Director-General, Army Medical Services.

Both before and after luncheon, guests and hosts intermingled and chatted happily together. Old friendships and acquaintances were renewed, while new friendships were formed among those who hitherto were known to each other by name only. The call to work brought an end to a very enjoyable luncheon party.

The guests were as follows :

Dr. F. M. B. Allen, Secretary, Medical War Committee, Northern Ireland.

Dr. G. C. Anderson, Secretary, Central Medical War Committee.

Lt.-Col. J. H. Anderson, A.D.G., A.M.S., Australian Forces in United Kingdom.

Capt. W. M. Anderson, Assistant Naval Attaché, United States Navy Medical Corps.

Sir W. Girling Ball, Chairman of Services Committee of Central Medical War Committee.

Maj.-Gen. H. P. W. Barrow, Colonel Commandant, R.A.M.C.

Maj.-Gen. R. J. Blackham, War Office representative on Medical Priority Committee.

General Sir Ernest W. C. Bradfield, India Office.

Viscount Dawson of Penn, Physician in Ordinary to H.M. The King and to Queen Mary.

Colonel de Cailly, Senior Medical Officer of Free French Forces.

Surgeon Vice-Admiral S. F. Dudley, Medical Director-General, Royal Navy.

Maj.-Gen. H. Ensor, Colonel Commandant, R.A.M.C.

Surg. Capt. E. E. Fletcher, Deputy Director-General for Dental Services, Royal Navy.

Professor F. R. Fraser, Director-General, Emergency Medical Services.

Major Gallemaerts, Senior Medical Officer, Belgian Forces in United Kingdom.

Col. Gergovich, Senior Medical Officer, Polish Forces in United Kingdom.

Major Leslie Haden Guest, Member of Parliament and Member of Parliamentary Medical Committee.

Lt.-Gen. Sir James A. Hartigan, Colonel Commandant, R.A.M.C.

Col. P. R. Hawley, Medical Corps, United States Army.

Lord Horder, Physician in Ordinary to H.M. The King.

Col. S. Langer, Senior Medical Officer, Czechoslovakia Forces in United Kingdom.

Brig. R. M. Luton, Deputy Director of Medical Services, Canadian Forces in United Kingdom.

Sir Edward Mellanby, Secretary, Medical Research Council.

Maj.-Gen. W. H. S. Nickerson, Colonel Commandant, R.A.M.C.

J. B. Parfitt, Esq., President, British Dental Association.

Lt.-Col. G. S. Parkinson, Dean of London School of Tropical Medicine and Hygiene.

Sir Frank Pearce, Past President, British Dental Association.

Professor R. M. F. Picken, Professor of Preventive Medicine, The Welsh National School of Medicine, Cardiff.

Col. A. H. Proctor, Dean, Post Graduate School, Hammersmith.

W. Rowley-Bristow, Esq., Consultant in Orthopaedic Surgery to the Army at Home.

Dr. A. G. H. Smart, Colonial Office.

Group Capt. L. Somerville-Woodwis, Chief Dental Officer, Air Ministry.

Lt.-Col. W. G. Trelford, Assistant Director of Dental Services, Canadian Military Headquarters.

Sir Alfred Webb-Johnson, President, Royal College of Surgeons.

Air Marshal Sir Harold Whittingham, Director-General, Medical Services, Royal Air Force.

Sir Charles Wilson, President, Royal College of Physicians.

The following were invited but were unable to accept:

Sir Francis Fremantle, M.P., Chairman, Parliamentary Medical Committee.

W. Kelsey Fry, Esq., Consulting Dental Surgeon, Ministry of Health.

Professor J. E. Gordon, Head of the Harvard Medical Unit and Representative American Red Cross.

Sir William Wilson Jameson, Principal Medical Officer, Ministry of Health.

Major Gunner Johnson, Norwegian Senior Medical Officer.

Major B. H. H. Neven Spence, M.P., and Member of Parliamentary Medical Committee.

H. S. Souttar, Esq., Chairman of the Central Medical War Committee.

Professor Sydney Smith, Dean of the Faculty of Medicine, Edinburgh University.

Professor Warrington Yorke, Dean of Liverpool School of Tropical Medicine.

ROYAL ARMY MEDICAL CORPS AND THE ARMY DENTAL CORPS COMFORTS GUILD.

THERE is not much to report since we wrote last month. We are glad to say that our appeal for fresh knitters met with a fairly good response but we still need more.

We were very glad to receive a letter from Gibraltar announcing the safe arrival of our parcel of books and games. We hope that we shall have further news from overseas before long.

May we again appeal for any books, magazines, indoor games and playing cards. It is increasingly difficult to get supplies of

these things and the men are so glad of them. West Africa has asked specially for magazines.

If there are any R.A.M.C. or A.D. Corps Officers' wives living near London who could spare time on Tuesdays to help us pack at the Officers' Headquarters Mess, we should be very glad of their help. Any further information can be obtained from the Honorary Secretary of the Guild.

*R.A.M.C. Headquarters Mess,
Millbank, London, S.W.1.*

ARMY CROSS-COUNTRY RUNNING.

THE London District Cross-Country Championship was held on November 22, when Private Maurice Bingham of The Army Dental Corps won the championship cup.

Bingham, who is the well-known Finchley Harrier, was in great form and scored a very easy victory in a field of 200 runners.

DEATHS.

BRIDGES.—In Cheltenham suddenly after an operation on Oct. 22, 1941. Major Arthur Brodie Hamilton Bridges, *O.B.E.*, *R.A.M.C.* Born Nov. 2, 1886, he was educated at St. Thomas's Hospital and took the *M.R.C.S.* and *L.R.C.P.* London in 1912. Commissioned Lieut., *R.A.M.C.*, from the *S.R.* Jan. 24, 1913, he was promoted Capt. March 30, 1915. He was Surgeon to the Commander-in-Chief in India from Sept. 14, 1916, till Dec. 4, 1920.

He was appointed Surg. Capt. 1 Life Guards Nov. 1, 1921, returning to the *R.A.M.C.* April 10, 1923, and was promoted Major Jan. 24, 1925. He retired Jan. 24, 1933. On Sept. 29, 1938, he took up a Retired Pay appointment at the Central London Recruiting Depot, Whitehall. He was recalled to the Active List on Sept. 2, 1939. He served in France from Aug. 1914, to Nov. 1915, and Feb. to Sept. 1916. From, Nov., 1915, till

Feb., 1916, he served in Gallipoli, Macedonia and Egypt. Mentioned in Despatches Jan. 1, 1916, he was awarded the *O.B.E.*, 1914 Star, British War and Victory Medals.

A correspondent writes :

"Bridges was a happy and imperturbable colleague with a very charming manner to everyone. He kept up his remarkable athletic activities and his games at squash were a revelation. He will be very much missed by both partners and opponents alike. Those who had the pleasure of working with him since the beginning of the war can scarcely believe that he is gone and will miss him sadly both as a fine friend and a very loyal brother officer."

DAVIS.—In York on Oct. 26, 1941, Capt. (Q.M.) Fred Davis, R.A.M.C. Born Jan. 10, 1875, Capt. Davis enlisted Feb. 10, 1893, and was commissioned Lieutenant and Quartermaster Feb. 21, 1915. He was promoted Capt. Feb. 21, 1918. He retired June 6, 1923, and on the outbreak of the present war he rejoined on Sept. 2, 1939. He served in South Africa, 1900–1902, being awarded the Queen's Medal with Clasps Cape Colony, Orange Free State and Johannesburg and the King's Medal with two Clasps. He served in France from Aug. 18, 1914, till 1919. Twice mentioned in Despatches he was granted the next higher rate of pay and awarded the 1914 Star, British War and Victory Medals.

WISHART.—On Nov. 8, 1941, at Gairloch, Capt. J. R. Wishart, The Army Dental Corps. Born on April 20, 1904, he was educated at George Heriot's School and the Incorporated Edinburgh Dental Hospital and School and qualified as a dental surgeon in 1927. He was commissioned as a Lieutenant on March 12, 1940, and served in the Scottish Command, being promoted to the rank of Capt. on March 12, 1941. Capt. Wishart, whose death was the result of an accident, was but recently married, and we extend our sincere sympathy to his widow in her tragic bereavement.

CONWAY.—On Nov. 12, 1941, Major Thomas Dowling Conway, R.A.M.C., Retired. Born Feb. 2, 1872, he enlisted Feb. 2, 1886. Commissioned Quartermaster and Hon. Lieut., Sept. 11, 1912, he was promoted Hon. Capt. July 1, 1917, and Major April 1, 1925. He retired Feb. 2, 1927. He served in the Nile Expedition of 1898 and was present at the battle of Khartoum, being awarded the Medal and Egyptian Medal with Clasp, Khartoum. He served in France from Aug., 1914, till the end of the war. Twice mentioned he was granted the next higher rate of pay and awarded the 1914 Star, British War and Victory Medals.

Colonel Ernest Janes, *O.B.E.*, writes :

"It was with deep regret that I heard of the death of Major T. D. Conway, on Nov. 12. I had the good fortune to serve with him at the R.A.M.C. Record Office, Woking, from 1920 to 1922, when he together with Lieut.-Col. Collier and myself were employed there in clearing up the residue of work from the Great War, restoring the Office to normal conditions, under Col. C. R. Evans. He has left on me the impression of a most conscientious officer who took his life and work very seriously and for whom nothing was too much pains. He had many lovable qualities and I have a very happy recollection of the times we spent together. He left the Record Office late in 1922 to proceed to Hong Kong, and whilst there he received his accelerated promotion to Major. He returned to England in 1926, and spent the last year of his service at Netley retiring for age in April, 1927. He called on me from time to time at the War Office and within the last year came to express his willingness to return to service with his old Corps, but he was then obviously ageing. His departure removes one who has left an excellent record of service and it must have been a great comfort to him in his later days to know that he was leaving two sons (Lieuts. John Thomas Conway and William Edward Conway, *M.M.*) in the Corps who were worthily carrying his good name. It came as a great shock to me to know that he was gone."

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects, travel, and personal experiences, etc. All such articles or papers, etc., intended for publication must be submitted **in duplicate** through the proper channels, i.e., Commanding Officer and A.D.M.S., or D.D.M.S., to the Under-Secretary of State, War Office (P.R. (O)), and not to A.M.D.2, otherwise such articles are liable to be returned to the authors and this may cause delay in publication.

Correspondence on matters of interest to the Corps, and articles of a non-scientific character, may be accepted for publication under a nom-de-plume.

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A free issue of twenty-five reprints, or any lesser number to the extent applied for, will be made to contributors of Original Communications and of twenty-five excerpts, or any lesser number as above, in the case of Lectures, Travels, Clinical and other Notes, and Echoes of the Past. Such free reprints or excerpts will, however, only be sent to those specifying their wish to have them and a request for same should accompany the article when submitted for publication, stating the number of reprints or excerpts required.

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Except as in the first paragraph above, communications in regard to editorial business should be addressed—"The Editor, JOURNAL OF THE ROYAL ARMY MEDICAL CORPS, A.M.D.5, Hobart House, Grosvenor Place, S.W.1."

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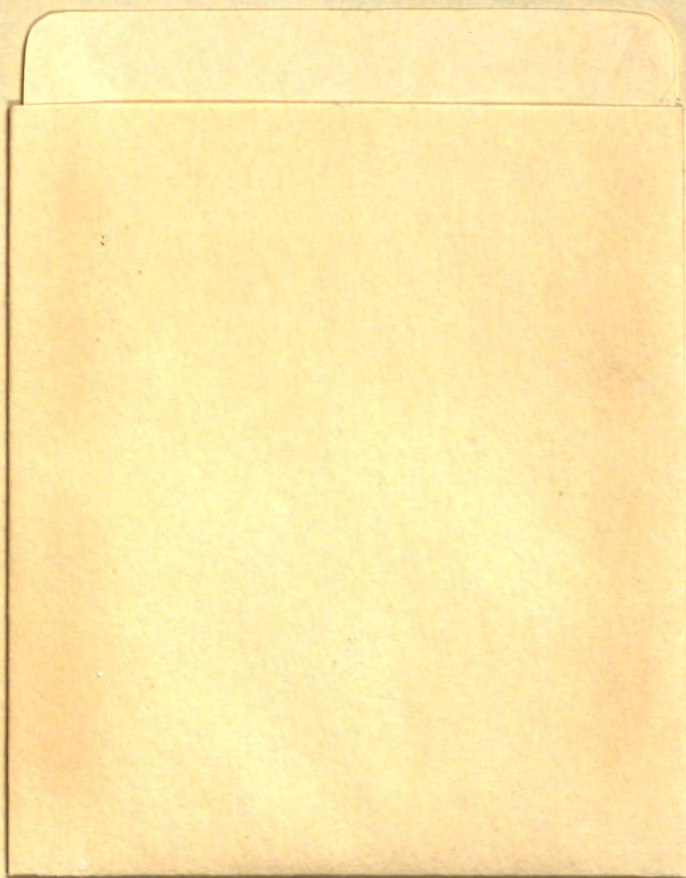
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